THE

# FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

## THE IRON AND STEEL TRADES JOURNAL.

VOL. 30. Thursday, July 31, 1924. No. 415.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
BESSEMER HOUSE, 5, DUKE STREET, ADELPHI,
LONDON, W.C.2.

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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

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## A Note on the Persistence of Large-Sized Graphite in Grey Iron Castings and Some Manufacturing Considerations.

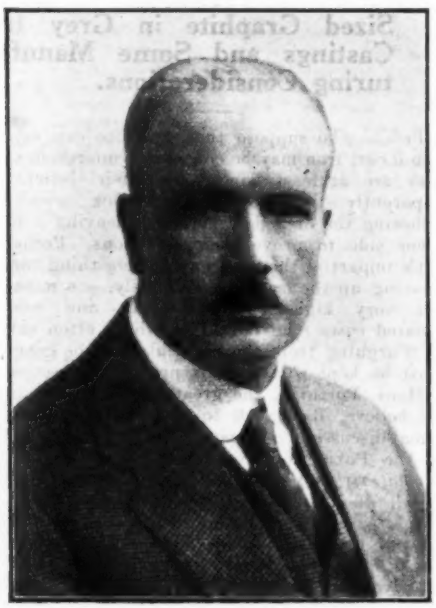
People who suppose that graphite can exist in liquid cast iron may be considered unorthodox, but they are at least sincere in their belief, and apparently those of the orthodox school are following the orthodox method of leaving it to the other side to prove their assertions. Perhaps a little impartial thought may do something towards clearing up the matter. Primarily, one must rule out very high-carbon material, and secondly isolated cases, the recital of which often savours of "arguing from the particular to the general," must be kept within their proper perspective.

Mons. Portevin, the great French metallurgist, we believe, did much to clear up the situation when discussing a paper relative to this subject at the Paris Conference. He said that *in the cupola melting of pig-iron the fusion is very rapid, and because of that the solution of the graphite lamellæ may not be complete, which without any doubt plays an important part and helps the development of the lamellæ during solidification and produces a greyer casting.* Mons. Portevin's reasonable explanation must be considered seriously, as it does not depart from an orthodox view except to interpose an insufficiency-of-time-for-the-solution-of-graphite element. Thus under certain cupola melting conditions, *inherent properties,* so far as they are controlled by the size of the graphite lamellæ can persist. But on the other side, since it is governed by a mechanical desideratum, then *controlled* cupola conditions should be capable of altering this balance. Certain well-known metallurgists often refer to "cupola control," but up to now the majority of papers on the subject of cupola practice have been given by practical men, and we await with interest a paper on this subject of controlling the operation of a cupola by a prominent works metallurgist. The inability to separate charges in the cupola has been proved by Dr. Moldenke, the use of receivers or mixing ladles with certain designs of cupolas all point to this rapidity of fusion. If fusion is slowed down to a considerable extent, it will bring in other troubles, and a paper giving concrete examples on this one point would be of the greatest importance to both technical and practical foundrymen. We suggest the title and scope of such a paper would be "The influence of variations in cupola melting speeds on the chemical and physical properties of some typical charges for making cast iron, with special reference to the size of graphite flakes." We imagine that controlled conditions would cost money, and it would then be possible for the small foundry owner to estimate whether it would be cheaper to buy expensive pig-iron which under his standard conditions can be relied upon to give satisfactory castings, or whether he could buy any type of pig-iron, analyse it, control his cupola conditions and produce an equally good material. We still maintain that with a basic electric furnace it is possible to start off with the cheapest and most impure scrap and produce the finest grade of steel, but it costs more than using reasonable scrap. We feel that somewhat similar conditions would prevail, *even when a full knowledge of the mechanism of cupola melting* is common knowledge.

XUM

## Death of Well-known Foundryman.

MR. E. H. BROUGHALL, who died on July 23, was formerly a vice-president of the Institute of British Foundrymen, which office he resigned last June on medical advice. The deceased gentleman had all his life been associated with the city of Coventry. He was born there in 1870, and was educated locally and at the Coventry Technical Institute. After serving a seven years' apprenticeship, Mr. Broughall some 24 years ago identified himself with Alfred Herbert, Limited, of Coventry,



THE LATE MR. E. H. BROUGHALL.

and up to the time of his death was manager of their Edgewick works and foundries. He had always taken a live interest in technical societies, joining both the Institute of British Foundrymen and the Coventry Engineering Society at their foundation. Before the Staffordshire Iron and Steel Institute and other societies he had read several papers dealing with the effect and use of denseners and the commercial and technical aspect of permanent moulds. Mr. Broughall was also a member of the Institution of Mechanical Engineers and the American Foundrymen's Association.

## Prominent Australian Foundryman to Tour England.

Mr. Robert Mason, of Adelaide, South Australia, a past-President of the Birmingham Branch of the Institute of British Foundrymen, arrived in England yesterday by R.M.S. *Osterley*.

Mr. Mason left England early in 1912, at which time he was a well-known member of the British Foundrymen's Association. During his stay in Great Britain he will be pleased to receive care of the English, Scottish, and Australian Bank, 5, Gracechurch Street, London, E.C.3, catalogues, pamphlets, and other publicity matter relating to supplies and equipment for iron, steel and brass foundry practice.

Mr. Mason will remain in England until October 15, when he returns *viâ* New York and San Francisco.

MR. ROBERT J. ANDERSON has resigned his position as metallurgical engineer of the U.S. Bureau of Mines, and is now engaged in general consulting engineering practice, specialising in the metallurgy of aluminium. His address in future will be P.O. Box 111, Fenway Station, Boston, Mass., U.S.A.

## Obituary.

MR. CHARLES KENT, of Kent Bros., engineers, Cobridge, died recently in his 53rd year.

MR. THOMAS LUMSDEN, managing director of the Lumsden Machine Company, Limited, Gateshead, died on July 17, aged fifty-six.

MR. FRANK BROOK, a director of the Gledhill-Brook Time Recorders, Limited, Empire Works, Huddersfield, died recently in his 64th year.

MR. THOMAS HASTIE, manager of the Edinburgh branch of Alex. Mathieson & Sons, Limited, Saracen Tool Works, Glasgow, died recently, aged 68.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Company, Pittsburg, U.S.A., and one of the world's leading electrical authorities, died recently.

MR. ALFRED WALKER, who died recently, aged 60 years, was for many years manager of the copper works of Thomas Bolton & Sons, Limited, of Froghall, Oakamoor, Stoke-on-Trent.

MR. GEORGE LAIDLER COOK, who died recently, was for many years secretary of Marshall, Sons & Company, Limited, Britannia Ironworks, Gainsborough. He joined the firm in 1863, and was elected a director six years ago. The deceased gentleman was 79 years of age.

## Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

### A Comment upon the Methods of Judging and Mixing Pig-iron.

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—Only to-day have I known of Mr. V. C. Faulkner having read, in locum tenens, my little note, and of the discussion upon it.

I take this opportunity of thanking Mr. Faulkner for his kindness and of assuring my critics that they will be answered in due course. Lest any one of them complain of not having the advantage of "the last word," I may say I am willing to debate this question on any platform which may be agreed upon mutually.

Yours, etc.,
H. J. YOUNG.

16, Ashfield Grove, Whitley Bay,
Northumberland.
July 18, 1924.

## Personal.

MR. E. C. SWAN has been taken into partnership by Swan Brothers, iron and steel merchants and agents, 3, Exchange Place, Middlesbrough.

MR. T. W. SIMPSON, managing director of John Shaw & Sons, Wolverhampton, Limited, has been re-elected president of the Wolverhampton Chamber of Commerce.

MR. THOMAS SCOTT, works manager of the Callendar Iron Company, Limited, Falkirk, has been the recipient of a presentation from the directors and employés of the company on the occasion of his retirement.

### Wills.

| | |
|---|---|
| MATTHEW, JOHN, of J. Matthew & Sons, Fireclay Works, Holbeck ... ... | £47,164 |
| GUEST, LADY THEODORE, widow of Mr. Thomas Merthyr Guest, the well-known Dowlais ironmaster ... ... ... | £315,272 |

## Mr. Cole Estep Returns Home.

Mr. Cole Estep, who has, for the past four years, been the European representative of the Penton Publishing Company of Cleveland, Ohio, sails on the *Baltic* for home next Saturday. Mr. Estep has been the European representative on the American Foundrymen's Association Committee on Technical Papers, and the Chairman of the International Relationships Committee, and in this direction has rendered signal service mondially to the foundry trades. Mr. Estep is a director of the Penton Company, and will assume control of some sphere of the activities of this concern on his arrival home.

# The Analysis of Grey Iron Foundry Alloys.

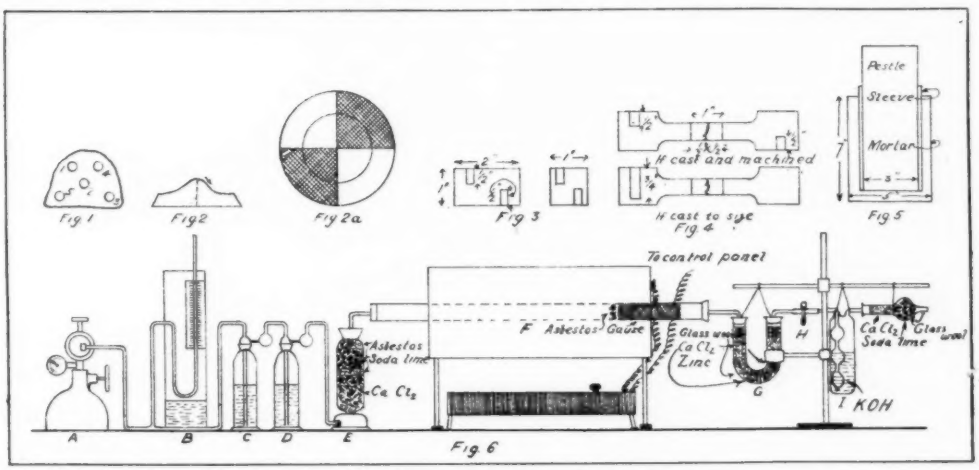
By H. H. S.

In a series of illustrated articles the writer proposes to set out methods for the analysis of pig-iron, cast iron (castings), ferro-silicon, speigel, silico-speigel, and ferro-manganese, which are, in his opinion, most applicable to grey iron foundry practice.

No claim is made as to originality of the methods, but in many modifications have been introduced, especially in respect of details.

The methods and system are put forward with the hope that they will present some useful and important points to the junior chemist, who so often encounters endless trouble through endeavouring to keep strictly to text-book methods.

The number of text-books dealing with the subject is bewildering, especially when one wishes to buy "the best"; in the main most of them are a valuable asset to the student for supplying knowledge as to *the principles and outline* of a variety of methods; many, however, fail to give information as to *details*, in the methods, the observance of which is necessary for the attainment of accurate results. It is often impossible to give proper attention to these details in a text-book, therefore the writer offers no apology for giving prominence to this most important section of the subject.




THE TOP HALF ILLUSTRATES A METHOD FOR SAMPLING PIG-IRON AND THE LOWER AN APPARATUS FOR THE DETERMINATION OF CARBON.

## Sampling.

This branch of metallurgical analysis more often than not receives scant attention, yet the foundation of success in analytical control depends upon the securing of a sample which is as representative of the bulk as the nature of the material and works practice will permit.

If a piece of pig-iron be drilled in several places and the drillings from each drill hole be analysed separately, the results obtained, even though accurate for any individual element, it does not by any means follow that the results obtained for one lot of drillings will agree with another; in fact the reverse may be the case, in regard to combined and graphitic carbon; and it certainly is so in respect to the manganese and sulphur contents of medium and high sulphur pig-irons.

A sample of drillings secured by drilling down the fracture, but near the bottom (top as cast) or flat surface, of such a pig-iron, will reveal a higher sulphur than a sample from near the top (bottom as cast). This is due to the fact that the sulphur compound manganese sulphide tends to rise to the top (as cast) of the pig during the cooling and solidifying of the iron.

At least two pigs should be taken as samples for each 5 tons of pig-iron, one being selected from the top and another from the bottom and opposite end of the truck. This sampling should be done in the presence of a responsible person; no "scraggy pieces" or "sows" should be taken as being representative samples; incidentally too great a proportion of these should be subject of a complaint to the suppliers, "sows" being often extremely difficult to break and handle, while "scraggy pieces" are invariably chock full of sulphur.

Where the amount of pig-iron per truck does not exceed 10 tons, one analysis made upon well-mixed drillings from at least four pigs will prove satisfactory.

The person who is responsible for supervising the sampling should note the fracture of the pigs as they are broken, and report upon any extensive change of the fracture from the normal. The writer has emphasised the necessity for this, and for the adoption of a combined fracture-analysis system for the examining and grading of pig-iron. This article appeared in THE FOUNDRY TRADE JOURNAL, volume 27, page 25.

The sample pigs are broken into half, then one half of each pig is broken again, from the inner quarter of each pig is then broken a piece of suitable size for drilling.

Each drilling section is drilled in three or five places, as indicated by Fig. 1, according as the contour of the fracture will permit, or as the controlling conditions of practice: for ordinary work three drill holes will in most cases suffice, but for purposes of arbitration five holes should be called for. The drilling is carried out by a $\frac{3}{8}$-in. high-speed steel drill, as a speed of about 250 revs. per min.; much higher speeds are not as efficient in cutting, and they considerably reduce the life of the drill.

The drill holes 1, 3, 4 and 5 should be at least $\frac{3}{8}$-in. from the top, bottom, and sides of the pig, but not too near the centre. Where five holes are made, the depth should be at least $\frac{1}{2}$-in., and double that if only three holes are made; while the depth of the centre hole should be approximately twice that of the other holes in the case of 5-hole drilling.

The drillings, representing each 10 ton or under, are well mixed, heaped into a cone and quartered, as shown by Fig. 2. One quarter is taken and mixed with the diagonally opposite quarter (Fig. 2A), and again heaped and quartered; for ordinary routine work it suffices to "cone" once only, remove one quarter and grind. The ground drillings are sieved, and all those passed by a "30" sieve are mixed well, after which they can be used for the estimation of any element.

When sampling test bars the method of drilling indicated by Figs. 3 and 4 is advised. In all cases where measurements are given, they are, of course, approximate, being given to express an idea of the proportion that should exist. It is just as easy to drill to a definite approximate depth than to drill haphazardly; most drilling machines have a depth scale, and in any case it is as easy to make and fit as to describe one.

When actual "jobs" are to be drilled, wherever

and whenever possible, drillings should be taken from each portion differing in sectional thickness, where such variation is known to effect the chemical constitution of the iron contained in the various parts of the casting, and where it is necessary for those parts to possess certain definite compositions and properties; here, again, proportionality of the drillings should be taken care of.

Ferro-silicon, speigel, silico-speigel, and ferro-manganese should be reduced to fine powders in a steel mortar (Fig. 5) with the aid of a sledge hammer. The pulverised material is sieved, that passing the "90" sieve is reground in an agate mortar, and it is then ready for use.

Carefully grinding of these alloys to an almost floury form is necessary if accuracy and rapidity are to be obtained, as they present difficulties in decomposing during their analysis, if they are not in a fine state of division, but with properly prepared samples their analysis is a fairly easy matter.

### Analysis of Pig and Cast Iron. Estimation of Total Carbon.

Of the many methods and modifications of methods known for the estimation of total carbon content of a pig or cast-iron sample, some involve elaborate and complicated apparatus, while others, in hurry to establish "the most rapid means of determination," are often too lax in the provision of safeguards to ensure accurate results. The method to be described is not claimed to be the most rapid, but it is claimed to give accurate results of a degree of fineness greater than is ever required in ordinary foundry work, and with a speed of working which cannot be objected to.

The most efficient and economical type of carbon furnace is obviously the electric one, its simplicity in construction and control, the control and maintenance of temperature, and the absence of gases, provides a standard of efficiency which the gas furnace of the Huxley type cannot approach. Furnaces having one, two, or four estimating tubes can be purchased, but for most foundries a two-tube one will be found ample, and, moreover, it is more convenient to operate than a larger size.

### The Purifying and Absorbing Train.

Fig. 6 illustrates the arrangement of the apparatus; for simplifying the illustration a single tube furnace and train is shown, and the purifying train is shown in the same line as the furnace; actually it should be a little to the rear of the latter, and E connects with the silica tube by a right-angle bend at right angle to that shown; this arrangement facilitates the placing of the boat and sample in the furnace. The oxygen gas is supplied from the cylinder A; 60 cub. ft. capacity is a useful size; its position is best situated at the end of the bench. B is an important piece of apparatus; it is a pressure gauge, enabling one to gauge to a nicety the flow of the gas, and to keep the flow constant. It can easily be made from a piece of fairly strong wall glass tubing, having a 3 mm. bore; the tube is bent as shown in Fig. 6, and fastened to a board having a white background. The scale tube length should be about 10 in. high. The tube is filled by suction with a solution of glycerine (2 parts), and water (1 part), coloured with a little ink, so as to give a double column of liquid 5 ins. in height. A scale, 5 ins. long, is marked off in $\frac{1}{4}$th ins. on the board, so that the meniscus of the liquid in the long tube corresponds with zero, when both liquid columns are at the same height (normal pressure). This simple apparatus is more serviceable than a mercury gauge. A slight alteration in the pressure or flow of the gas causes a difference of level between the two columns of liquid which is very noticeable, thus enabling the operator to maintain with ease a steady flow of gas.

C and D are Dreschel gas-washing bottles, C being filled to $\frac{1}{3}$ with 50 per cent. KOH. D with concentrated $H_2SO_4$. These serve to dry and purify the oxygen, while E serves as an additional precaution in this respect. It comprises a lime tower $\frac{2}{3}$ filled with well-fused $CaCl_2$ and $\frac{1}{3}$ soda lime; on the top of the latter is placed a thin layer of asbestos wool.

The silica tube F should be at least 26 ins. long and 1 in. dia. At the exit or absorption train end is placed a roll of 30-mesh copper gauze, which has been previously heated so as to give a copper oxide surface. About 3 in. of the roll, which should be about 6 in. long, should extend within the furnace; at the inner end is a small wad of asbestos.*

The object of the copper gauze roll is two-fold, it oxidises any carbon monoxide which is not absorbed by KOH, to carbon di-oxide; further, it enables the combustion boat to be easily and correctly positioned within the furnace. Some chemists use asbestos wool instead of copper gauze, but the writer favours the latter, as being more efficient, and not liable to delay the passage of the gas, as is asbestos, especially if too tightly packed which is often the case.

The gauze should be rolled as closely as possible. Each end of the silica tube is closed by a one-hole rubber bung.

The U-tube G measures 4 in. × $\frac{5}{8}$ in.; in the upper portion of the left-hand tube is a 1-in. layer of coarse calcium chloride. Proceeding towards the right limb, below the calcium chloride and separated from it by a layer of glass wool, is a 1-in. layer of 20-mesh zinc drillings. Following is another glass wool wad, after which the remaining part of the tube (both limbs) is filled with 10-mesh $CaCl_2$ (calcium chloride), except for a thin glass wool layer at the exit end. The zinc drillings prevent the passing of any sulphur gases formed from the oxidation of the sulphur in the iron passing into the absorption bulb.

Many of the absorption bulbs on the market are too fragile for works analysis; perhaps the most favoured and efficient type of tube is that designed by Arnold. It is simple in construction, is easily filled and cleaned, and it will withstand fairly rough usage. One measuring 6 in. × 1 in. is recommended; for use sufficient 50 per cent. KOH to fill two bulbs is introduced. As an extra safeguard against possible escape of some $CO_2$, there is attached to the exit end of the bulb a small (4-in.) $CaCl_2$ tube, the first half being filled with 10-mesh soda-lime, and the exit end with 10-mesh $CaCl_2$, after which is a plug of cotton wool.

### The Estimation.

The current for the furnace is switched on according to instructions given by the suppliers; here, it may be pointed out that, to secure long life for the heating coil it is better to give the furnace time to attain the correct temperature on that temperature amperage (stated on the instructions) than to heat up rapidly on the maximum amperage; the latter considerably decreases the life of the heating coil. To ensure that the correct temperature range of 950 to 1,000 deg. C. has been reached a test should be made with the pyrometer.

For the determination, weigh off four times the carbon factor weight, 0.2727, *i.e.*, 1.0808 grams; a good plan is to prepare an aluminium weight equal to this and so save time; the prepared weight should be tested periodically as to its accuracy. Spread the drillings along about a 1 in. portion of the bottom of a fireclay boat; the Morgan Crucible Company manufacture a convenient size known as Z.17. These are shallow and if broken into half they serve admirably for many combustions at very little cost.

When the furnace is at the correct temperature, the bulb I-J is placed in position; the oxygen is turned on a little before releasing the clip H; this prevents the possibility of the KOH "sucking back." The oxygen is then allowed to run through the train at a rate of about 120 cc. per min. (= 3 in. approximately) for 10 minutes.

The rate, pressure, and time are given indicating a particular practice; it cannot be taken as absolutely correct for all apparati, but the flow of 120 cc. per min. is quite fast enough to ensure accurate results.

The gauge pressure required to be indicated to give the correct rate of flow is found by adjusting the flow until it reaches the given rate, as indicated by measuring the volume of oxygen collected over water by the water displaced. This test should be carried out by collecting the oxygen, passing over for a certain period, in a gas jar or measuring cylinder supported in a *shallow dish* of water. A deep vessel should not be used, as it

* [If a silica tube is used, we pre-sume that the copper oxide is likely to form a copper silicate slag, which would in time bore its way through the tube. If a porcelain tube, which we personally prefer, the danger is lessened. More detail on this point would be appreciated.—EDITOR.]

increases considerably the resistance to the flow of the gas, and gives very erroneous results. Having once established the correct rate, all that is required when carrying out an estimation, is to turn on the gas until it registers the difference in level of the gauge corresponding to that shown in the rate test.

Close the clip H when the oxygen has passed through the complete train for ten minutes, turn off the oxygen, and place in the furnace a boat containing a sample, then insert the bung. This procedure allows the sample and boat to heap up to the correct temperature while the bulb is being weighed.

After weighing reconnect the absorption bulb, and turn on the gas exactly as before, and for the same time, after which disconnect the bulb and re-weigh.

$$\frac{\text{Difference in weight} \times 100}{4} = \text{Total carbon per cent.}$$

The time allowed for the combustion of the carbon is best controlled by an alarm clock interval timer, such as used for photography. Using the apparatus described, ten to twelve minutes is ample time. It may even be found that for other apparatus less time is necessary, but ten minutes should be the minimum for foundry work.

The absorption bulb will last for eight to ten estimations, by attaching to the exit end of the bulb; a small gas-washing bottle half-filled with a clear saturated solution of barium hydroxide, and using the absorption bulb until signs of exhaustion of the KOH are shown by precipitation of barium carbonate in the $Ba(OH)_2$ tube, one can ascertain how many determinations can be made safely for one filling of the bulb. The number permitted should be two less than that which indicates exhaustion and which will give a consequenty low result.

The purifying and drying apparatus C. D and E will last for six months or more, while G. will be safe for 2 to 3 months' service, it should be changed when the $CaCl_2$ shows signs of acute deliquescense.

## Personal Organisation.

BY W. J. HISCOX.

The manager of a busy foundry is not accessible to his subordinates at every hour of the day, and yet his attention is needed urgently at times. The methods adopted by the subordinates for obtaining audience depend largely upon the characteristics of the manager, for whereas one will only grant audience at specific times, no matter what occasion may arise, another will do so at any time when he is not otherwise engaged.

It cannot be said that either constitutes an ideal method, for both are responsible for wasted time. In defence of the first, it may be urged that the manager is right in taking precautions against constant interruptions on trivial matters, for in every foundry there is at least one person whose chief delight it is to "run after the manager," seizing upon any pretext to gain the end he has in view. It is to be feared that such attentions are not always actuated from disinterested motives, and it is perhaps well that they should be discouraged.

On the other hand, a matter of some importance, demanding immediate attention, may arise, and if the manager is accessible only at definitely stated times, there is the possibility of trouble ensuing. The subordinate may leave the matter in abeyance until the time appointed, when he can consult with his chief, or, realising the urgency of the matter, and knowing that he cannot see the manager for some time, he determines to attend to it himself. In connection with the first, delay may have serious results, whilst in connection with the second, the matter may be adversely affected by inexperienced handling.

Dealing with the manager who is always accessible when not otherwise engaged, it will be found that this individual is very rarely disengaged, and so the subordinate spends a good part of the day in seeking an opportunity for an interview. The man goes about his work in a "semi-detached" sort of way, with one eye always upon the manager's office, for he knows that if he relaxes his vigilance only for a few minutes, it is probably that he will be forestalled. Thus his work suffers, and the time of the manager, although fully occupied, is not so productive as it might be.

Some endeavour to overcome the trouble by sending to the manager notes, visiting cards, and the like, but this often results in a conglomeration of matter that cannot be attended to efficiently. No matter how careful the manager may be, there are matters which are overlooked, through lack of time, or because the importance of the message is not grasped. He does not always keep a clerk with him for the purpose of classifying the various messages, and it is better for an automatic system, simple yet effective, to be introduced. Such a one is represented by the following, the chief item being a small metal rack, which is fixed to a bracket on the manager's desk. This rack is provided with a number of pockets, designed to hold cards, size 3 in. by 5 in., and each pocket will hold, if necessary, six cards. A label appears over each pocket, showing the nature of the matter accommodated therein, such as "Machine Matters and Repairs," "Outside Supplies," "Delays," "Blueprints and Patterns," "Callers and Appointments," "General Notes," etc.

Each subordinate official is provided with a supply of blank cards, and when there is matter to bring to the notice of the manager, he writes brief particulars upon a card, and places the card in the appropriate pocket. It is a simple matter for the manager to peruse the contents of these pockets at periods throughout the day, and to take what action is necessary, either alone or in consultation with a subordinate.

In the case of an extremely urgent matter, a special pocket is set apart, irrespective of the actual matter concerned, and the contents of this pocket naturally receive prior attention. It is necessary to guard against abuse in this connection, but if the delinquent receives a "wigging," he is in no hurry to repeat the offence. The card is not necessarily scrapped after the first use, for in most cases the particulars can be entered on one line, and when the matter has been dealt with by the manager, the card can be returned to the person from whom it emanated, for further use in connection with similar matter. The manager himself can also make use of the system for the purpose of "reminders," especially in connection with callers and appointments, by jotting down particulars upon a card, and placing it in the pocket set apart for the purpose. The system has been tried and found to be very effective.

**Tinplate in France.**—It is reported that the Etablissements Métallurgiques de la Gironde are embarking on the manufacture of tinplate.

**Canadian Exports of Non-Ferrous Metals.**—During the past three years there has been a very large and steady increase in the exports of non-ferrous metals from Canada, the last two years showing exceptional gains. The exports for the twelve months ended May, 1924, were valued at $66,814,381, an increase of $16,172,779 over the previous twelve-month period, and of $38,302,704 over the twelve months ended May, 1922.

**Standard Steels for Automobiles.**—The following publications on automobile steels have recently been published by the British Engineering Standards Association (28, Victoria Street, Westminster, S.W.1.): No. 5,005-1924 (Wrought Steels); No. 5,006-1924 (Cold-Worked Steel Bars and Strip); No. 5,008-1924 (Valve Steels and Valve Forgings); and No. 5,009-1924 (Steel Tubes). These specifications cover the chemical composition, heat treatment, mechanical properties and margins of manufacture of sixteen wrought steels, seven cold-worked steels, four valve steels and four classes of steel tubes commonly used in the automobile industry. Each publication also contains a series of general clauses relating to heat-treatment definitions, method of carrying out the mechanical tests, preparation of test samples, and particulars of the standard tensile, bend and notched-bar impact test pieces. A similar publication (No. 5,007-1924) on sheet steels for automobiles has just been completed and will be published shortly.—Specification No. 5,027-1924 has also been just issued (superseding No. 80-1917) relating to Magnetos for Internal-Combustion Engines. It covers four types of magnetos used for internal-combustion engines, excluding those for aircraft engines. A further specification (No. 204-1924) contains a list of terms and definitions used in connection with telegraphs and telephones. Copies of these publications may be obtained from the B.E.S.A. Publication Department.

# A New London Foundry.

The foundry which has recently been started up at the North Woolwich Works of Messrs. Harland & Wolff, Limited, was, of course, laid down expressly to meet the requirements of the extensive ship-repairing and engineering shops which have recently been erected and the equipment of which is now completed. There is, however, no doubt that the foundry will have a very much wider field of usefulness, for there is certainly a very healthy local demand for high-class castings; indeed, although the foundry has only been in operation for some few weeks, the local demand has already made itself very evident, and it has been just as readily catered for. The management no doubt realise all the possibilities of this local trade, whilst consumers of castings will certainly not send to outside foundries for productions which they procure on their own door-step, as it were. The castings produced at Woolwich Works are bound to be of a high-class

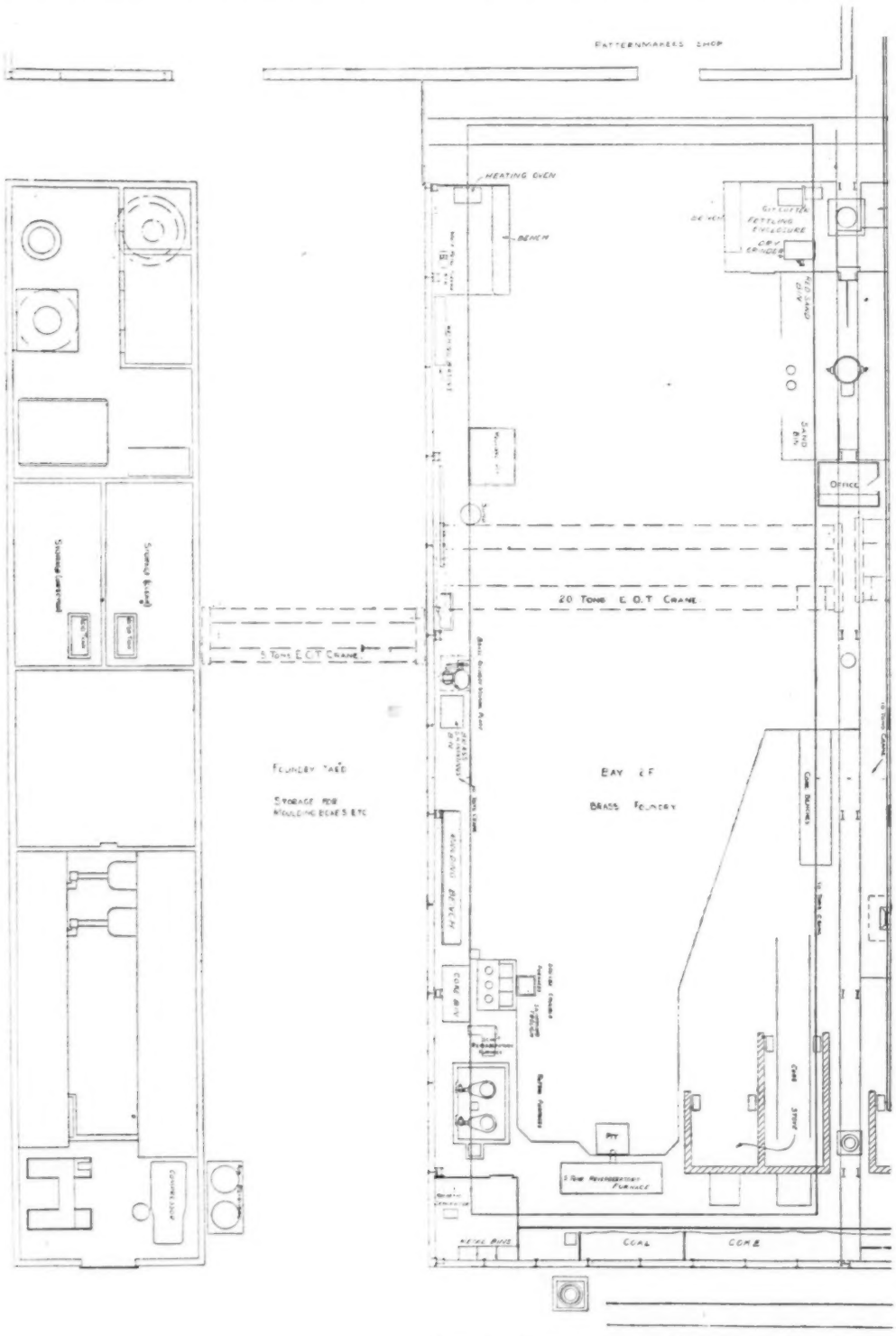


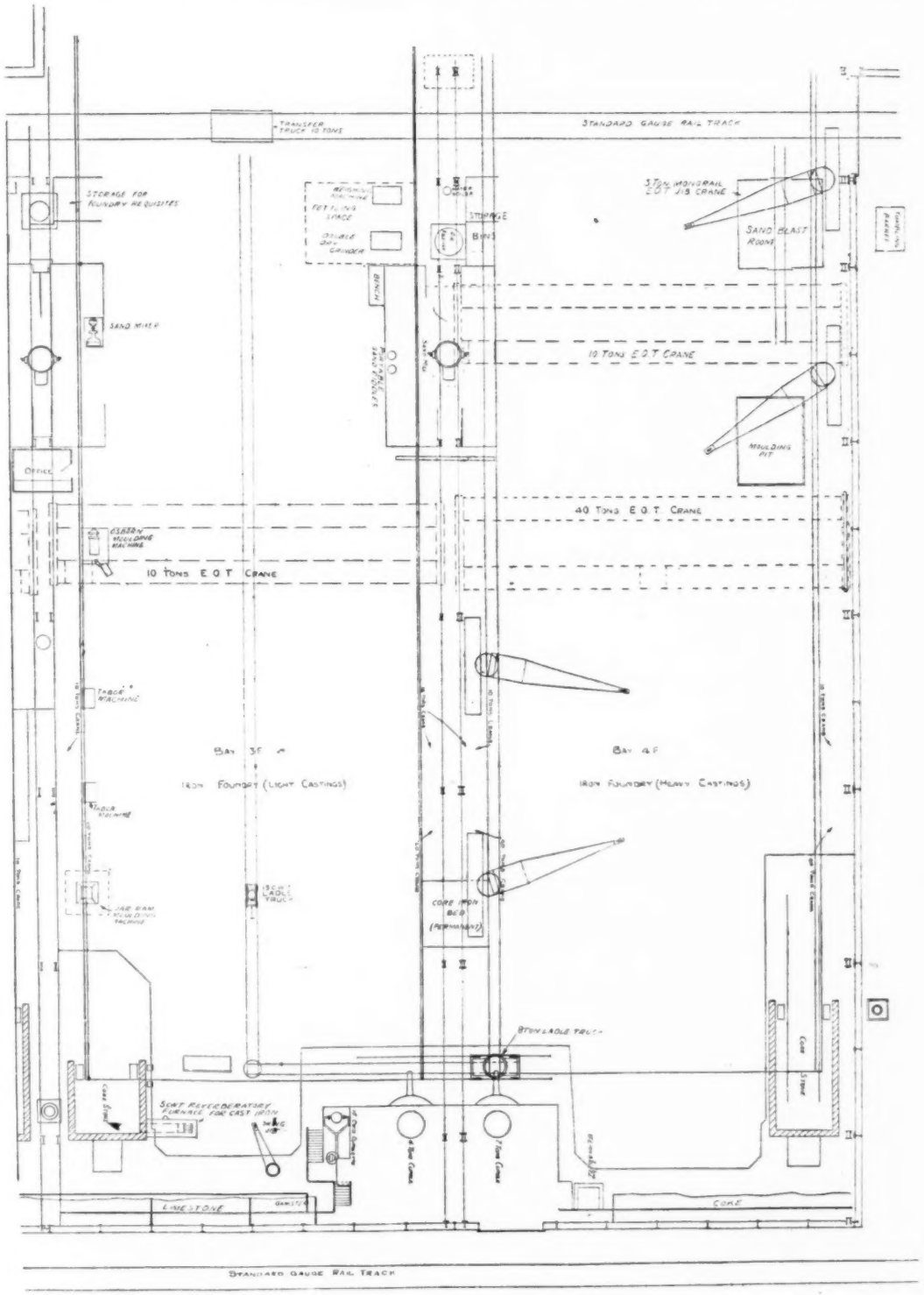

FIG. 1.—PLAN OF THE LAY-OUT OF THE NEW LONDON

quality, the nature of the work upon which the company themselves are engaged make that imperative.

The situation of the works are in every way ideal; they lie parallel to the entrance of King George's Dock, and the Company have their own wharfage, whilst through the Port of London Authority's sidings they are in direct communication with the main line of railways. The works are completely encircled by sidings, so that there is no dead end, and lines of standard track are also laid into the shops. The wharf is also served by the same sidings, whilst a Booth 5-ton loco crane is employed to deal with material on the stocking ground, as also for intercommunication between the shops.

### Sanitary Features in Lay-out.

The foundry, of which we illustrate the lay-out (Fig. 1), is covered by three bays, each 240 ft. long × 75 ft. wide; these bays are devoted respectively to the heavy and light castings and the brass foundry. As will be seen from the elevation (Fig. 2), the building is particularly lofty, very amply ventilated with north lighting in the roof and all-glass sides. In the layout the unusual provision for the comfort of the men is impressive. There is very ample lavatory accommodation, the




FOUNDRIES OF MESSRS. HARLAND & WOOLF, LIMITED.

lavatories being lined with white glazed bricks throughout. Adjacent to the sides of the building are a series of coat racks, the coats, etc., being hung behind these racks are out of sight, and thus the neatness of the foundry is added to. Provision is made for boiling water for the men, whilst the

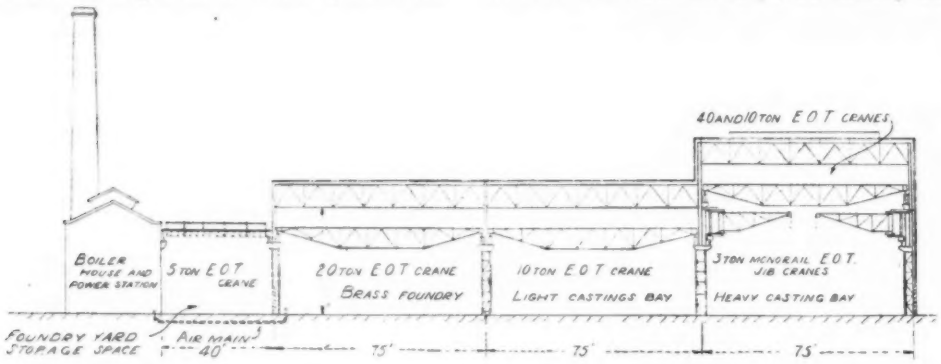



FIG. 2.—ELEVATION OF THE NEW FOUNDRY BUILDING OF MESSRS. HARLAND & WOOLF, LIMITED.

drinking fountains in the foundry take the form of a button-controlled vertical jet. No cups are provided, so that the best sanitary conditions are preserved.

The foundry floors are laid, as to the brass foundry, with 3 ft. 6 in. of yellow sand, the light

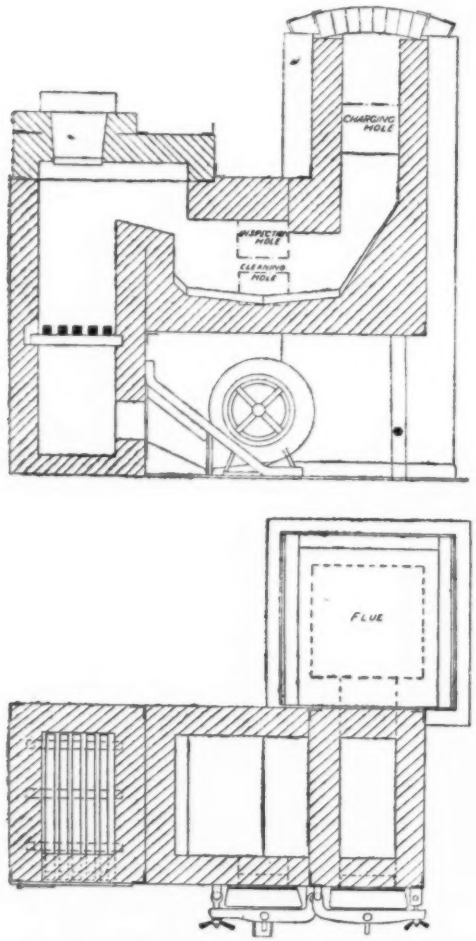



FIG. 3.—PLAN AND ELEVATION OF THE BRITISH REVERBERATORY COMPANY'S FURNACE IN THE NEW FOUNDRY OF MESSRS. HARLAND & WOOLF, LIMITED.

iron foundry with a similar thickness of black sand, and the heavy foundry with a mixture of black and red sand of a depth of 4 ft.

The heavy casting bay is served with a 40-ton Chaplin crane and four 3-ton mono-rail electric cranes, which are carried on gantries below the main crane at a height which prevents fouling.

The light casting bay is served with a 10-ton Chaplin crane, and the brass foundry by a 20-ton Chaplin crane. The crane runways are, however, common to the machine shops, the foundry being separated therefrom merely by a line of standard track, so that the shop cranes are also available for service in the foundry bays.

### Raw Material Handling.

Raw materials are brought in by rail to the sidings immediately at the rear of the stock bins, into which the materials are discharged direct down shoots. The sand mixing shop for the foundry is in the mid position, the various grades of sand being stored in bins. The equipment, in addition to air-riddles and pan-mills, includes a Blackfriars disintegrator. Sand for the core shop is loaded into a special box which is handled by the shop crane and discharged into hoppers above the core bench.

### Melting Plant.

The melting plant in the iron foundry consists of two 7-ton cupolas, which were built by the Company, a Green's 1-ton emergency cupola, and a 7-cwt. reverberatory furnace; this last serves as a reservoir to enable the foundry to deal expeditiously with castings required for urgent repair work. The waste heat from this furnace is utilised in the core stove.

It will be noted that the disposition of the melting plant is such as serve both casting bays with equal facility. A track in front of the cupolas carries an 8-ton ladle truck, the ladle being handled by the shop crane. The light casting bay is also served by a 15-cwt. ladle truck, which travels upon its own carriage the full length of the casting bay.

All charges are weighed on the floor level, and are then delivered by a Chaplin 3-ton revolving jib crane to the charging platform. This crane is arranged for hand control from a platform which extends for the full length of the stocking ground and charging platform.

The blowing plant is housed in a dust-proof building, which is placed below the charging platform. The blowing plant consists of two Thwaites blowers, which are each driven through a single reduction gear by Laurence Scott motors. The cupolas are blown at about 1 lb. pressure.

Slag troughs are provided at the rear of the cupolas, and the dump is run into bogie ladles. The core stove in the heavy casting bay is 24 ft. × 10 ft. 6 in. × 2 ft., and that in the light castings bay 13 ft. × 12 ft. × 7 ft. These stoves are coke-fired, and they are served by carriages which are mounted upon ball-bearing wheels. In the heavy castings bay there is a casting pit 16 ft. deep × 12 ft. × 16 ft. In this pit at the time of our representative's visit a 15-ft. hydraulic ram was being cast. Another interesting casting being made was a propeller which had been struck out with spindle and race.

The machines installed include a No. 2 Britannia jar ram, two Tabor S.P. 14-in. × 16-in. machines, and an Osborn roll-over jarring machine. The foundry is also served by a portable hot air dryer, the hot air being delivered by a Sirocco fan.

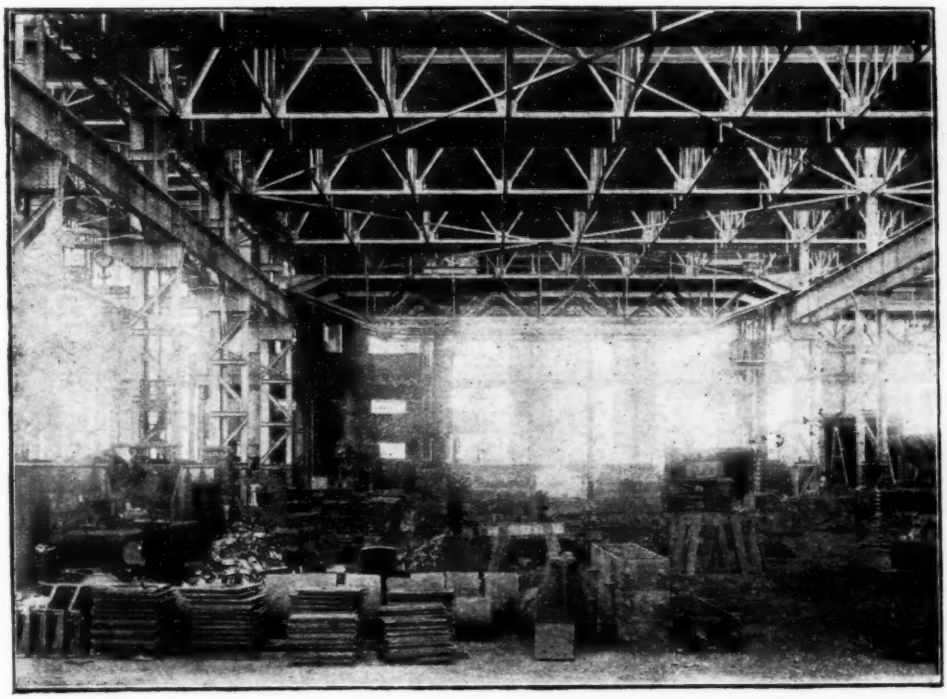


FIG. 4.—LOOKING TOWARDS THE CUPOLA IN THE LIGHT CASTINGS BAY.

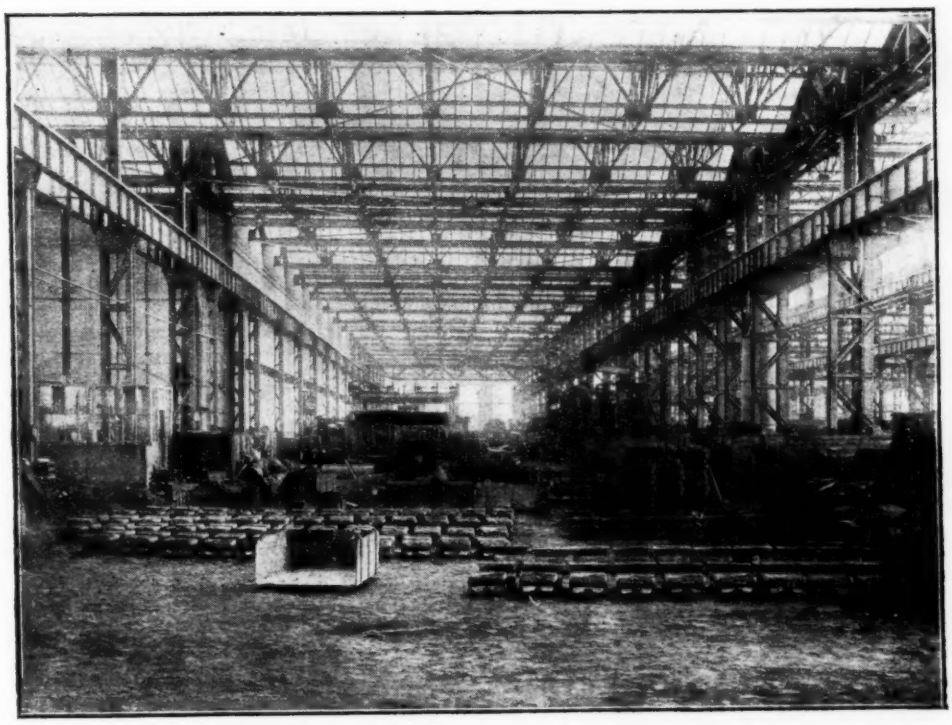


FIG. 5.—THE LIGHT CASTINGS BAY TAKEN FROM OPPOSITE DIRECTION TO FIG. 4.—MESSRS. HARLAND & WOOLF, LIMITED.

XUM

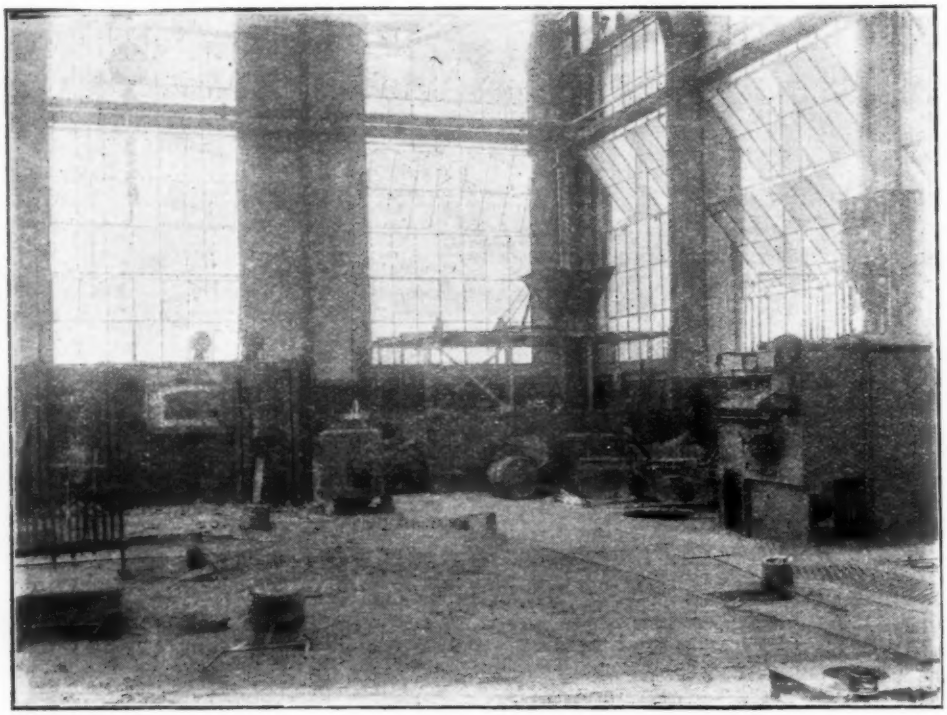


FIG. 6.—THE BRASS FOUNDRY PLANT EQUIPMENT INCLUDES TWO REVERBERATORY FURNACES, TWO TILTING FURNACES, AND A METAL RECOVERY PLANT, ALL OF WHICH ARE SHOWN.—MESSRS. HARLAND & WOOLF, LIMITED.

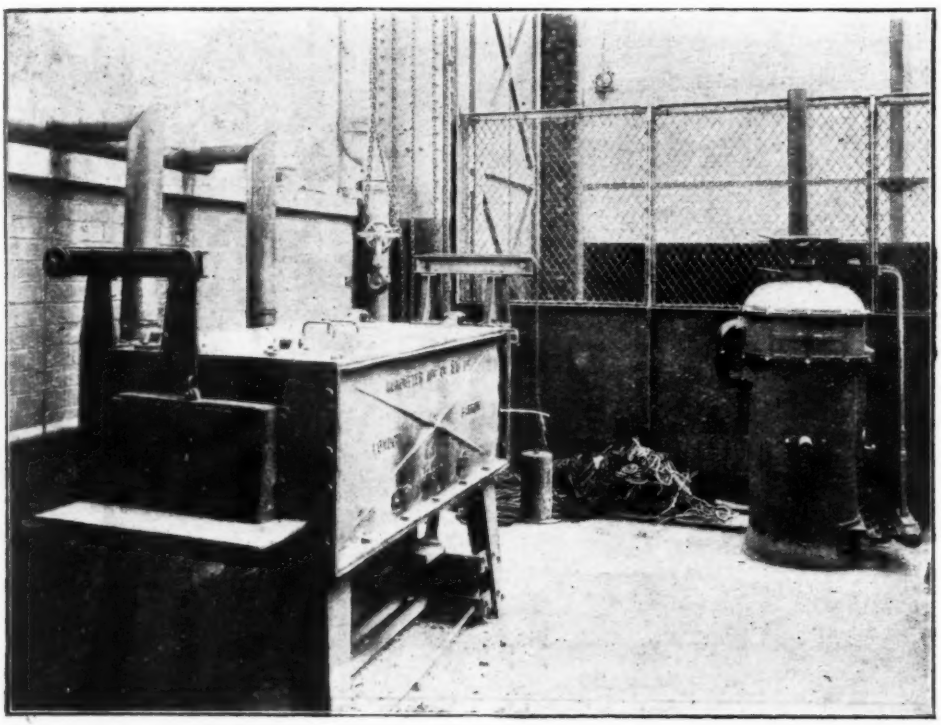


FIG. 7.—THE WHITE METAL MELTING SHOP.—MESSRS. HARLAND & WOOLF, LIMITED.

The melting plant in the brass foundry comprises a 5-ton reverberatory furnace of the company's design, a 5-cwt. reverberatory furnace by the British Reverberatory Furnaces Company. The

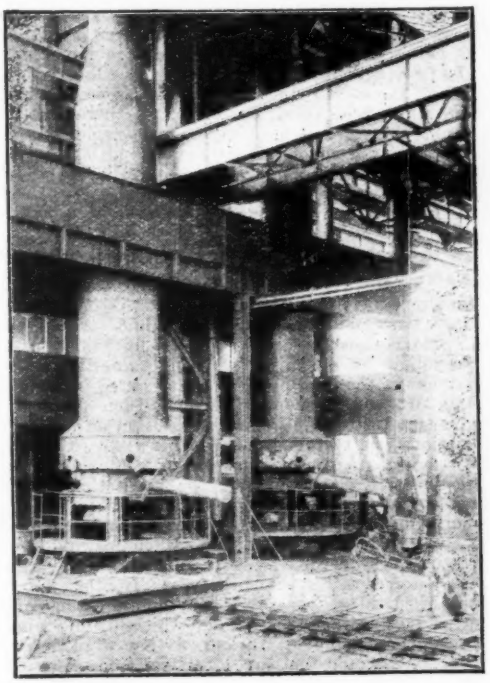


FIG. 8.—THE CUPOLA MELTING INSTALLATION HAS BEEN DESIGNED BY THE WORKS STAFF.—MESSRS. HARLAND & WOOLF, LIMITED.

length of this furnace is 5 ft. 6 in., height at highest point 6 ft. 5 in., and a width of 2 ft. 4 in.; the connection to the underground flue is 2 ft. 5 in. There are two 300-lb. Morgan tilting furnaces and three 200-lb. pot furnaces.

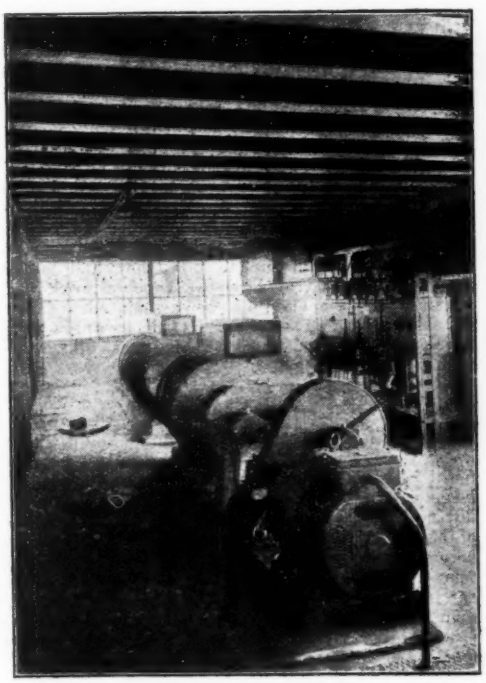


FIG. 9.—THE BLOWER HOUSE IS PLACED BENEATH THE CUPOLA CHARGING PLATFORM.—MESSRS. HARLAND & WOOLF, LIMITED.

There are two core stoves 24 ft. × 10 ft. 6 in. × 12 ft. and 13 ft. 6 in. × 12 ft. × 7 ft. respectively. The casting pit, which is built of iron plates, is 16 ft. deep × 8 ft. × 14 ft.

The auxiliaries in the brass foundry comprise a brass recovery washing plant, and in the precious metal stores, a magnetic separator and revolving sieve. This first is fed from a chute from outside of the stores.

The white-metal shop contains an oven to melt the white metal out of bearings and a 600-lb. metal furnace, both supplied by the Monometer Company. The fettling enclosure contains a git cutter and a double head grinder, which are driven by Laurence Scott motors.

A complete system of town's gas under pressure is laid down for mould drying.

Boxes are stored in the foundry yard, which, as will be seen, extends for the full length of the foundry, and is served by a 5-ton Chaplin crane.

## Rustless Cast Iron.

The Bulletin of the British Cast Iron Research Association for the June quarter contains an article on "Rustless Cast Iron," in the course of which it is pointed out that irons containing 20 per cent. silicon are practically non-corrodible, but also unmachineable. Variation of silicon between 1.24 and 2.28 per cent. has no influence upon the corrodibility of grey cast iron, either in acid or neutral media, providing the amounts of graphitic and combined carbon remain constant. Irons of silicon content less than 12 per cent. do not appear to have much advantage over ordinary grey iron so far as corrosion resistance in acids is concerned, but it must be borne in mind that corrosion tests in strong acids do not afford much guide in considering ordinary conditions met with in practice. Above 15 per cent. silicon the increase of resistance to corrosion does not justify the higher cost and greater difficulty of manufacture. An iron of this content should have a combined carbon content of 0.8 per cent.

Little information is available regarding the influence of phosphorus, but it has been stated (1900) that an increase of phosphorus percentage from 0.01 to 0.85 per cent. reduces liability to corrosion by some 30 per cent. Recent work, however, shows that ordinary grey iron in dilute (N/100) hydrochloric acid behaves according to its phosphorus content in such a way that the higher the phosphorus the greater the corrosion. This is known to be true for P. from 1.5 per cent. downwards. The P. is left behind in the graphite and does not go into solution.

Since the condition of carbon is largely determined by silicon, the influence of carbon upon corrosion is complicated. White cast iron, however, is more resistant to acid corrosion, and grey cast iron is more resistant to corrosion in alkaline and neutral media. It has been found that, unlike mild steel, the addition of copper to cast iron does not reduce the corrodibility, but copper up to 2 per cent. retards corrosion in dilute sulphuric acid. Nickel up to 1 per cent. reduces solubility in dilute sulphuric acid, but a larger nickel percentage yields an alloy more corrodible than the ordinary iron, while manganese is generally believed to retard corrosion in iron.

The Association is already conducting some preliminary tests on corrosion-resisting low-silicon alloys, and contemplates a wider range of tests, and members will shortly be asked to specify the service conditions their castings, which give trouble due to corrosion, have to withstand.

ALFRED HERBERT, LIMITED, of Coventry, have appointed Arthur Balfour & Company (Canada) as their sole selling agents for the Dominion, with offices at Montreal, Toronto, and Hamilton.

IT HAS BEEN DECIDED to organise a company of $1,000,000 capital to manufacture electrolytic iron from scrap on a commercial scale. Plans comprehend establishing a plant in the United States with daily capacity of 20 tons. The parent company under the new arrangement is Electrolytic Iron, Inc., jointly owned by the French interests which have been developing an electrolytic process at Grenoble, in France, and by Mr. Charles P. Perin, consulting engineer, New York, who has been independently developing methods of securing pure iron products by the electrolytic process from pyrites and pyrrhotite.

# Institute of British Foundrymen.

## LONDON BRANCH.

### Discussion on Major Rhydderch's Paper on "Moulding Sands."*

MR. WESLEY LAMBERT (Past Branch President) said he had been pleased to hear the lecturer mention the work of Professor Boswell, because he did not think foundrymen were sufficiently acquainted with the excellent work that Professor Boswell had done in connection with sands. One of his brochures dealt more particularly with moulding sands, and gave the composition and grading of practically all the sands in this country, as well as a number of those on the Continent, and he (Mr. Lambert) commended the book to all foundrymen.

#### Pressure and Fusion Point.

He was very interested to listen to the lecturer's statement respecting the lowering of the fusion point of refractories due to pressure, and said that he must admit that this was the first occasion on which he had realised the true significance of pressure in this connection. He thanked Major Rhydderch for having called attention to this point in its relation to refractories.

#### Milling of Sands.

Referring to the milling of sands, it had been shown that after ten minutes' milling of a particular sand, further milling had very little effect on the size of the grains of sand. In this connection the lecturer had spoken about crushing. But did a mill crush? He was of course aware that milling reduced conglomerates by crushing, but did it crush the grains, or was the grain size reduced by attrition, *i.e.*, by surface wear brought about by one grain rubbing against another? Personally, he thought it was a question of attrition, and that one grain wore against another and reduced the grain size. After ten minutes' milling the bonding material became distributed around each grain, and it then acted as a lubricant, and he thought that the reason so little reduction in the grain size was apparent when the milling was prolonged beyond the initial ten minutes was due to the bond acting as a lubricant, and thus very little additional wear of the grains resulted. They had seen that the Belgian and French red sand did not appear to change very much as the result of milling, and he thought it feasible that the bonding material in that sand may be found to be distributed round each grain, and therefore was acting as a lubricant from the very commencement of the milling.

#### Permeability of Sands.

Mr. Lambert then referred to a slide from which it was seen that there was a very big discrepancy between the observed and calculated permeability of one sand. He would like to know whether Major Rhydderch had repeated that test, because the discrepancy might possibly be due to some leakage in the apparatus, or an error of observation. The remainder of the figures on the slide in question seemed so concordant that he himself would not have shared Major Rhydderch's disappointment had he carried out that work. He would have regarded it as a step in the right direction, and would have considered that he had certainly achieved promising results by this method of calculation. He would not have been so disappointed as Major Rhydderch appeared to be, but would have looked for some external factor to account for the discrepancy. Mr. Lambert asked the lecturer whether he considered that the time was close at hand when synthetic sands would be used largely. By a "synthetic sand" he meant the compounding of a more or less pure silica sand and a bond incorporated together in such a manner that, instead of using natural moulding sands of varying and unknown qualities as at present, they would be made up of silica sand and a bond to standard formulæ for various classes of work. He believed this to be the solution of a great many troubles which the foundryman has in connection with his sands.

MR. F. A. MELMOTH pointed out the difficulty of either criticising or offering any constructive remarks on a Paper such as that given by Major Rhydderch without a good deal of previous study. He fully agreed that the question of the sand was almost the most important point in connection with the making of good castings, and there was no doubt that it had been very much neglected. It was a very common experience to find, as the lecturer had pointed out, that the corner in which the sand was prepared was given the very least attention in the foundry.

#### Refractoriness Not Always First Consideration.

Major Rhydderch had pointed out that the question of the fusibility of the sand was of extreme importance, and in particular he had stressed the importance of the fusibility of the finer portions of the sand. Surely this was largely a question of the amount of the finer portions that existed in a given bulk of sand? In one case the fusion point was given as 1660 deg. C. and the fusion of the finer portions was 1440 deg. C., which was an extremely low figure. Assuming that only a small proportion of fine material existed in the sand, that should not be a reason for condemning the sand as a moulding sand. His experience, and that of a good many others, had been that, when making steel castings, to overdo the refractoriness of the sand was a defect rather than otherwise. In other words, one liked to see the sand cake slightly, and come away freely from the casting, which, to his mind, presupposed incipient fusion. If one went beyond that one would get an erosive action from the molten metal, and the sand would burn on; he considered that that was caused more by erosion than by purely temperature or lack of refractoriness of the sand.

#### Standardisation Essential.

The lecturer had pointed out that the time had come for someone to put up standards for sands. He personally felt that every Paper he had read on the subject—although it was probable, of course, that he had not read them all—had been concerned definitely with the type of work with which the man who wrote it had been connected. The only real source of such standardised information was an independent laboratory. It had been said that the Americans had gone a long way in that connection. Probably that was due to their castings associations. He believed there was a steel castings research association in America, and no doubt it had done a great deal of work in that connection. Standardised conditions were most unlikely to be quickly obtained through foundrymen expressing their own opinions. That *might* result in ultimate standardisation, but up to now they had merely applied observed facts to the type of work with which they happened to be associated. Consequently, the next man might try to apply those particular observed facts to his particular work, and meet with disaster.

#### Pressure and Fusion Point.

Continuing, Mr. Melmoth said he would like to know what was the theory of the reduced fusion point of a sand under pressure. In the case of large castings one had, probably erroneously—he did not say "correctly"—ascribed the burning on of a sand to the fact that, owing to the castings being of a large type, they had retained their high temperature a great deal longer than would a small casting, and had transmitted that heat to the mould face, so that the mould face was raised to a much higher temperature for a longer time than would be the case if the castings were thin. He would like to know what confirmation there was of the statement that sand actually had a lower fusion point when under pressure. With regard to silt, the lecturer had stated that a good deal had been said about silt in sand, and he (the lecturer) had not been able to prove that it was detrimental up to 50 or 60 per cent. Mr. Melmoth suggested, tentatively, that the effect of silt might be that, given a normal ramming, one was liable to produce a harder mould and, consequently, a closer mould.

* This Paper appeared in our issues of May 29 and June 5.

### Influence of Silt.

If, as the lecturer had pointed out, finer grain-size had the effect of raising the strength of the sand, both in a green mould and in a dry mould, and reducing permeability, then surely, if one carried that to its logical conclusion—as, with silt, there was a finer grain-size than ever—it increased the strength of the mould, and its closeness, by the presence of the silt. He would like to know whether that was not the fact, or whether the lecturer had had the moulds which contained silt more lightly rammed than the others, or more efficiently vented.

### Influence of Milling on Sand.

MR. G. C. PIERCE, after thanking Major Rhydderch for his splendid lecture, said he felt somewhat at a loss. The lecturer had rather confused him with regard to a theory he had held for a number of years—and he believed he was not alone in holding that theory—with regard to the milling of sand. He believed it had been accepted generally, at least so far as green sand work was concerned, that the over-milling of the sand had a very bad effect upon the castings. At least, he had attributed that bad effect on the castings to the over-milling of the sand until he had heard Major Rhydderch's lecture. In his own experiments he had found that if he took one portion of a batch of sand and milled it for two or three minutes, and then worked it, the casting turned out satisfactorily. If, however, he took another portion of the same batch of sand and milled it for, say, a quarter of an hour or twenty minutes, the casting was a bad one. The lecturer's remarks tended rather to attack that theory. He did not know whether he had to "unlearn" what he thought he had learned, or whether the lecturer would enlighten him further on the point.

### Taking up Expansion for Eliminating Pressure on Bricks.

THE BRANCH-PRESIDENT (Mr. V. C. Faulkner) said he was astounded that two such prominent metallurgists as Mr. Lambert and Mr. Melmoth should have asked the lecturer on what grounds he had stated that pressure lowered the melting point of refractory materials. Surely any foreman bricklayer, in putting up a furnace, left distance pieces between the bricks, to take care of expansion. It was not merely expansion, however—that could look after itself in many ways—but surely it was because he did not wish to put the bricks under pressure, because a brick under pressure had a lower melting point than one which was not under pressure. He should think that that was why vertical vents were left in the side walls of furnaces and pieces of wood or other material were inserted to burn away in arches, so that no bricks should be under pressure; it was constantly in his mind that any refractory material under pressure had its melting point lowered.

### Synthetic Sands.

With regard to synthetic sands, these had always been built up with a combination of silica sand and fireclay. He asked the lecturer, however, if he had come across an attempt to build up a synthetic sand with silica and a ferrous bond.

### Applicability of Data for Small Foundries.

Major Rhydderch had been transferred from one of the largest foundries in the world to a comparatively small one. He asked Major Rhydderch quite candidly if he would be able to apply the information he had gained, and which he had imparted to the members of the Branch that afternoon, in a small foundry, because, if it could be applied in the small foundry with which he was associated, it could be applied in practically all foundries in Great Britain. He suggested, in all seriousness, that the British should form a committee for the study of moulding sands, its members to be foundrymen, or people very definitely connected with the foundry. So far as he was aware, only five members had experimented to any extent with moulding sands, or, at least, had published their results. They were Fletcher, Smalley, Holmes, Shaw and Major Rhydderch. A corresponding committee could be formed, and he felt sure that, at the conference in 1925, such a committee ought to be able to put before the Council of the Institution of British Foundrymen some standardised tests.

## THE AUTHOR'S REPLY.

MAJOR RHYDDERCH, in reply to the discussion, said there was no doubt that Professor Boswell had done a really wonderful amount of very valuable work regarding these sands. The book to which Mr. Lambert had referred ought to be in the hands of everybody, because even at Sheffield it revealed sources of supplies of sands of which people were absolutely ignorant. By reference to that book foundrymen could find out exactly whether a sand would be of suitable grain size, and they could find out its analysis, about which the author had given a great deal of information.

With regard to Mr. Lambert's remark as to the discrepancy between the observed and calculated permeability of a sand, he said the experiment had been repeated. He had tried every means possible to check the figures, in order to see whether there were any leaks, but had not found anything wrong with the apparatus.

### Synthetic Sands.

As to the future of synthetic sands, there was no doubt that the use of these would come, but he did not know whether they were very necessary in this country, with our naturally bonded sands. He had done a certain amount of work on synthetic sands, using sillimanite, which had a melting point of 1880 deg. C., and magnesite, with a melting point of 2800 deg. C., and with each of those, mixed with fireclay, the skin did not fall away. They would not come into use, however, until the price was reduced. With regard to magnesite, the contraction was very high, and for this reason, if it were used for dry sand work, trouble could be anticipated. Even drying at 150 deg. bad cracking in the mould would take place, unless care was taken, owing to this very high contraction. With sillimanite quite good castings were produced. The sillimanite used was almost dust, and he should say that there was about 80 per cent. silt, 10 per cent. clay, and 10 per cent. sand. The only point he was agitated about, however, was whether it would skin.

### The Fusion of Sands.

Replying to Mr. Melmoth's remarks as to fusion, he said there were silica grains with a very thin layer of bond round them. That bond had a very low melting point. When it reached the temperature of fusion it knitted up with all the other bonds, and caking resulted. In small work, the caking was neither here nor there. He agreed that everybody liked to see it, but with heavier work the caking trouble was likely, and it usually burned on. In small work the cooling was rapid, but when these sands were used on larger work, the fettling costs rose rapidly. With regard to ferrostatic pressure, he said, the particles in the bricks were covered with a bond; the particles were heterogeneous, and the moment one started to apply the load there was shear. The test was carried out with a 1-in. cube, and a pressure of 25 lbs. to the sq. in. was applied, and there was shear due to all the fine grades beginning to sinter first. That was dealt with in very great detail by Dr. Mellor in the proceedings of the Ceramic Society. Also Bradshaw and Emery had dealt with it in about 1917, from which Paper these extracts had been made. It was definitely expounded to the very last letter. In fact, Dr. Mellor's works were recognised the world over.

### Silt Considerations.

With regard to silt, he could only say what he had noticed, *i.e.*, that it was a nuisance, and that it produced a harder mould. However, he was not worrying so much about the strength as the permeability, and, after all, the test to show whether the sand was sufficiently permeable was when it was machined to see what it was like under the skin. In the case of very large pinions, weighing 10 to 15 tons, he had seen men during the fettling actually chipping out the sand.

### The Effect of Milling.

Coming to the remarks made by Mr. Pierce with regard to milling, Major Rhydderch pointed out that he did not advocate that the sand should be milled for 15 minutes. He had merely said that at 15 minutes the sand reached a uniform state, and that further crushing had no effect. Milling for a period of two minutes was sufficient for some sands, and 15 minutes would ruin them. All he had done

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was to give a specific instance of a particular sand and a particular mill. What he was getting at was not so much the specific results he had obtained as the method by which he was tackling the problem, and he left individuals to tackle the problem on their own lines in order to get the information they required. If he had been working with a sand of a different grain-size, he would have obtained a different result. He could conceive that foundrymen could have sands with grains of such sizes that milling did not make the permeability worse; it might even be improved.

**Shape and Size of Grains Determines Permeability.**

Permeability was absolutely dependent on the shape and size of the grains present. The Paper by Schwartz was a very interesting one, as showing the effect of grain-size on permeability. There was a diagram which showed that although one could crush a sand to a finer state, one could maintain its permeability.

**Ferruginous Bonding.**

Replying to the President's remarks as to the ferrous bond, he said he had not added such a bond. It was interesting to note that the Plauson Mill people could reduce all these sands and ferruginous matters into a perfectly colloidal state. The City Analyst at Sheffield had been carrying out very similar work, but not on sands, and he had specimens which had been maintained for months in this colloidal state. He had added a few per cent. of gum to maintain them in that state. That had struck him (Major Rhydderch) as interesting, and he had written to the Plauson people and suggested that he should send them some samples so that they could render them colloidal by their process, and then he could make some synthetic sands. At present they did not hold out great hope on the grounds of expense. However, by rendering this ferruginous bonding into a colloidal state, we could make a direct experiment to find out the actual value of the ferruginous bond.

**Applicability of Results to Small Foundries.**

As to whether or not this testing could be carried out in a small works, he saw no reason why not. All that was needed was simply a little box arrangement, in which one could ram from three sides—any junior could make it—and a little drop plate. It was necessary to ensure that the sand was dry, then add moisture—the moisture must be controlled very carefully—let it stand for a certain length of time, and then carry out the test. In permeability tests he had taken a weldless drawn tube, and had calibrated it carefully. He could work to within 1 per cent. for permeability estimations. All that was required was two flasks, which should be given a definite drop. He advocated that anybody who was starting this work should start on the American method, so that he could have something with which to compare his results. The Americans had adopted a definite standard, and their work was to be turned out on that basis.

Any further work he could do in this direction would be carried out, using the American standards as a basis. This would yield comparative figures.

The actual carrying out of the tests required no technical or manipulative skill.

**VOTE OF THANKS.**

MR. W. B. LAKE, proposing a vote of thanks to Major Rhydderch for his instructive lecture, said he felt a particular interest in it, because for many years he had taken a great interest in moulding sands for steel. He felt he had received some very valuable information from the lecture, and no doubt other members would agree that they also had been enlightened on many points concerning foundry sands generally, as well as steel moulding sands.

MR. J. W. GARDOM, who seconded, said he was interested in the fusion points of various mixtures, and also in the question of the variation of the fusion point as the result of pressure. The lecturer had given us something which would enable us to visualise sands, and he considered that the success of sands in the foundry, or in any other trade, would come from a man being able to visualise what was going to happen. People often asked: "What is the good of the metallurgist or the chemist: we have done these things for many years, and why pay for their services now?" That was all right until something went wrong. If we had a process of visualising the sand it would help us to realise what was going on in the sand, and we had some new theory which we could apply to it if anything went wrong.

The vote of thanks was accorded with acclamation.

MAJOR RHYDDERCH, in returning thanks, said he hoped that his effort would be of some use to the members. There was no doubt that in carrying out such work they would follow many blind alleys: he had not touched upon many of the blind alleys that he had encountered. There was also no doubt that, when speaking to the essentially practical man—who, undoubtedly, is a man of distinct ability—that man could not express in words exactly what he knew. The tragedy of the Institution was that the practical moulder did not take part in its activities. It was remarkable that the very extensive knowledge of these men was gained by rule of thumb methods. He considered that the Institution was a little behind, in that its members did not encourage that type of man sufficiently.

## Institute of British Foundrymen.

**Newcastle Convention Fund.**

In connection with the fund which was raised for the last annual convention, the Hon. Treasurer (Mr. H. F. Parsons) announces the final list of subscriptions as follows:—

Amount previously acknowledged, £546 16s.; Messrs. Martha Simm & Sons, £10 10s.; Messrs. Chorley & Pickersgill, Limited, Leeds, £5 5s.; The Northern Press and Engineering Company, £5; Messrs. John Smith & Sons, £3 3s.; Messrs. Seaton Carew Iron Company, £2 2s.; Messrs. J. Taylor Dunford & Company, Limited, £2 2s.; Messrs. R. & W. Collin & Company, Limited, £2 2s.; Messrs. George Denham & Company, £2 2s.; Messrs The Cambridge and Paul Instrument Company, £2 2s.; Mr. M. B. Herbst, £2 2s.; Mr. A. B. Binns, £2; Mr. J. J. Collin, £1 1s.; Mr. J. W. Thompson, £1 1s.; Mr. T. S. Collin, £1 1s.; Mr. W. S. Ireland, £1; Mr. J. D. Henderson, £1; Mr. J. McDonald, £1; Mr. T. Savage, 10s. 6d.; Mr. T. Mudie, 10s. 6d.; Mr. E. H. Brown (London), 10s. 6d.; Mr. C. M. Mayhew, 10s.; Mr. J. D. Blythe, 10s.; Mr. R. W. Futers, 10s.; Mr. H. Robertson, 10s.; Mr. G. Scott, 10s.; Mr. John Clark, 5s.; total, £595 14s.

## B.C.I.R.A. Bulletin No. 4.

We like the arrangement of the fourth bulletin issued by the British Cast-Iron Research Association. It shows a better appreciation of the relative importance of matter than has been exhibited in previous issues. All abstracts are now classified under eight headings, which arrangement has obviously to be a little elastic to include everything, and perhaps a ninth, bearing the caption "Miscellaneous" could be usefully added. The bulletin is in future to be published quarterly, which will help the realisation of the main object of the publication—that is, the maintenance of something approaching a personal contact between the Association and its members.

## Patent Specifications.

*Particulars of complete specifications accepted, furnished by Mr. Eric Potter, Patent Agent, of Lonsdale Chambers, 27, Chancery Lane, London, W.C.2. Printed copies of the specifications in the following list are now on sale.*

PETTIS, C. D. Moulds for use in casting metals. No. 218,427.

NAYLOR, G. W., and NAYLOR, J. F. Ingot moulds. No. 218,445.

ECKERT, OPPELT, ET CIE, GES. Cores for steel castings. No. 206,135.

HOLLEY, E. Process for producing self-annealed cast-iron castings in permanent metal moulds. No. 209,043.

HOLLEY, E. Means for applying lamp-black to the surface of metal moulds. No. 214,953.

## Association Technique de Fonderie.

The annual convention of the French Foundrymen's Association will this year be held at the Conservatoire des Arts et Metiers from November 21 to November 23, under the presidency of Mons. Ramas.

# A Method of Moulding a Condenser.

Before describing the practical details of the moulding and core making for the making of a cendenser, it should be stated that the main dimensions of the casting are:—Depth, with top and bottom flanges, approximately 8 ft.; diameter, 10 ft.; the inside diameter of the body, 9 ft.; thickness of metal, 1¼ in. The steam chest flange

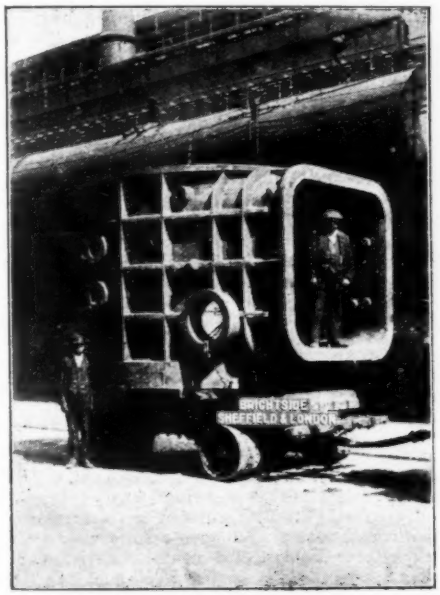


FIG. 1.—THE FINISHED CASTINGS.

is 7 ft. 3 in. square, and the exhaust opening 6 ft. 3 in. square. A bulbous rib runs round the casting at three different heights, and ribs, spaced round the circumference of the body, cross these and run from top to bottom of the casting. There are ribs also behind the steam chest flange; at various places round the body are pipe open-

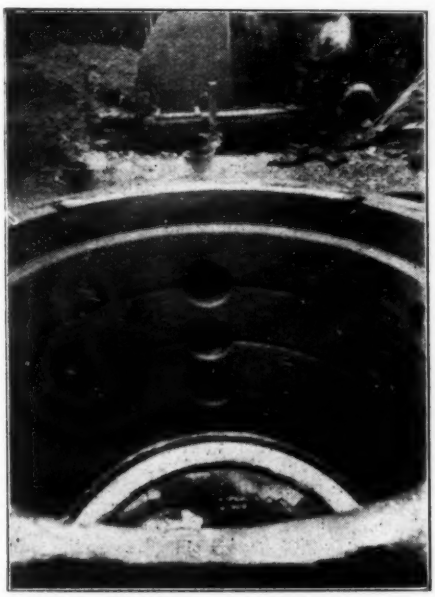

FIG. 2.—THE MOULD FOR THE CONDENSER.

ings, and two atmospheric exhausts are positioned one each side of the casting, near the steam chest. In addition, there are several facings, ribs, and bosses, both on the outside and inside of the condenser. The latter, when machined, weighs approximately 12½ tons. Fig. 1 illustrates the casting ready for despatch.

A full pattern is provided, framed up and lagged on the outside, with a 10-in. head above the top flange, to ensure cleanliness and solidity of the casting. The numerous ribs are loose, as are also the various pipe facings and bosses. There is a 4-in. print on the bottom for the locating of the main core, and a 6-in. print to centre the steam-chest core. The bulbous ribs are contained in segment cores, which fit into prints, as provided for

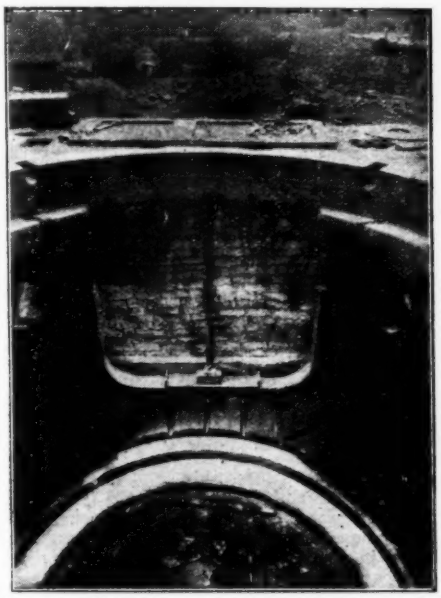

FIG. 3.—MOULD SHOWING CHEST OF CONDENSER.

on the pattern. These, together with core boxes and strickles, were made at the Wicker Works of the Brightside Foundry and Engineering Company, Limited.

A bottom plate, about 12 ft. in diameter, made in open-sand and with six lugs, is placed in position in a pit about 9 ft. deep. The print and a

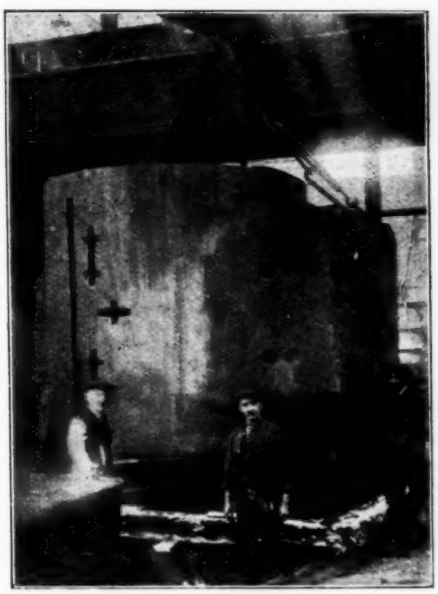

FIG. 4.—THE CORE READY FOR LOWERING INTO THE MOULD.

level bed are then swept, and the pattern is placed upright in this location. The mould is built up, using bricks and loam; a building ring is used about half-way up, which, in addition to its lugs, contains cored slots about 2 in. from its outside diameter. Another ring, with similar lugs and slots, is built in about 3 in. from the top. A joint is made at the radius on the top of the steam chest

and at the centre of the atmospheric exhaust openings. A very strong grid, with five lifting hooks, is placed on this joint, and bricks and loam are used to build up to the flange joint, which is then made. A flat top is strickled up separately on a plate, which has six lugs, and on which dabbers are cast to form the runner box. The drawback over the steam chest is then lifted out, slipped, blacked, and finished. The pattern is rapped and withdrawn, to be followed by the drawing in of various loose ribs, facings, prints, and bosses. The segment cores forming the bulbous ribs are now fixed in their prints, and the mould is blacked, finished, and fired. When the mould is dry, a space having been left behind each pipe-opening-print, the cores are placed and held back to the face of the mould by ropes suspended from the top joint. Iron bars are then fixed through the slots of the building rings, which are then bolted to the bottom plate. Figs. 2 and 3 give two views of the mould.

### The Construction of the Core.

The mould being ready for the core, a lifting plate is made with eight lugs on the inside diameter, upon four of which are loops to be used later in the bolting together of the various building rings. A bed is first of all swept—with print—and on this the lifting plate is placed. The core is built up with loam and bricks, and three building rings are used in the course of construction. These rings are made in halves and secured at their joints, and are made thus so that they may be released when the contraction of the metal takes place. In addition to this, and for the same reason, two "thirling" bars are built in the core, and may be withdrawn, by means of hooks, at the desired moment. The core is built up and then strickled in the usual manner, the ribs and bosses being located from the strickle. The bottom lifting plate and building rings are then bolted together with long bolts. After this, the core is dried ready for the assembly of the chest core. The latter is made in a separate core-box, and is supported by a grid, which carries six large loops. The core is rammed up with dry sand, withdrawn, finished, and dried, and then bolted on to the main core in the following manner:—

Bolts with a hook at one end and screwed at the other are connected to the six loops of the chest-core-grid. The two lugs on each of the three building rings have a cored slot in them, and in these two strong iron bars are fixed, and plates, with suitable holes, are butted up against them. The screwed ends of the bolts, referred to above, are then taken through these holes, and secured by nuts. This ensures that the chest core is held rigidly upright and in true relation to the main core. The complete core is then ready for dressing and blacking, previous to stoving. After drying, the core is thoroughly checked by the pattern-maker. Fig. 4 shows the finished core ready to drop into the mould

Clays are placed in the mould at various places, and the main core is tried in, and if the thickness is as is shown in the drawing, it is finally located. The pipe-opening cores are then brought forward up to the face of the main core, to avoid flash at these points. The space behind their prints is then rammed, as is also that behind the chest core. The drawback over the chest core is next tried in, and clays are again used to measure the thickness of metal, and, if this is correct, the core is placed in position. The inside of the core is then rammed to a height of 18 in., and the vent is taken off through the top. The space between the outside of mould and the pit is rammed up so far, the rest of the mould being supported by bars from the pit sides. The vents are led off at various places, and the top is then placed in position and bolted down.

### Making the Runners.

Ten runners are dropped right down to the mould, and one large riser is taken off the head of metal on the casting. In addition, three risers are taken off the steam-chest flange. The metal used is dense, close-grained, and mixed very carefully to chemical analysis. The metal must be melted under modern controlled conditions in order to satisfy the requirements of the customer in respect to the specified tensile and transverse tests. After a short time the building rings of the core are released, as are also the thirling bars.

The quality and mixing of sands used, the careful moulding and core making, the finish of the mould, and the metal—produced, as far as possible, under scientific control—all tend to ensure a good, clean, and solid casting.

## Catalogues Received.

**British Empire Exhibition Propaganda.**—We have received from Electric Control, Limited, of Empire Works, Bridgeton, Glasgow, an advance copy of a new illustrated four-page leaflet—No. 12H/X—which gives examples of the firm's exhibits at the British Empire Exhibition. These include "Empire" automatic control gear for lifts, hoists, pumps, compressors, machine tools, steel-mill auxiliaries, capstans, cranes, winches and winders. It is well printed in black and blue on stout paper, and copies may be had on application.

**Billet Shears.**—Messrs. Henry Pels, of 40, Great Marlborough Street, London, W.1, have sent us a four-page leaflet dealing with their heavy-duty shears. We would suggest that in future publicity matter the firm uses tons per square inch instead of lbs. per square inch, because to most of us it needs a calculation to visualise what the former figures mean.

**Wires and Cables.**—The fifteenth edition of the wire and cable catalogue has been received from the General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2. It contains full data concerning every type of Pirelli-General V.I.R. insulated wires and cables of both association and non-association grades, tough rubber cables and flexible, aerial cables, flexible cords for all services, bell and telephone wires, signalling wires, etc. The information is set out in a clear manner, and is boldly printed on good paper. For ease of reference the catalogue is divided into five sections, in addition to the introductory pages, upon which are given views of the Pirelli-General Cable Works at Southampton and illustrations of various typical cables.

**Mould Drying.**—Messrs. T. Ketin et F. Thiriart, of Sclessin-Liege, Belgium, have sent us a four-page folding leaflet which describes a mould-drying stove of the semi-portable type. Some interesting figures are given of the amount of coke consumed to dry various types of moulds for large castings.

**The Products of Iron and Coal Works.**—The Staveley Coal and Iron Company, Limited, of Chesterfield, have sent us a copy of a souvenir booklet which they distributed to members of the British Waterworks Association on the occasion of their visit on July 5. The booklet contains one of the best descriptions we have ever read of a large works, and the illustrations are both clear and well chosen.

**Anti-friction Metal.**—We have received from Messrs. Thermit, Limited (a constituent company of Messrs. Nobel Industries, Limited), of 155, Church Road, Battersea, London, S.W.11, an interesting sixteen-page brochure dealing with their "Eel" brand anti-friction metal. After a short introduction, a complete report, issued by the National Physical Laboratory, is given, which is illustrated by microphotographs and line drawings of the apparatus used for the tests. The report shows that there is no depreciation in quality after repeated castings. We understand the brochure is available for the foundry trade on application.

**Metal Flux.**—We have received from the Lancashire Metal Flux Company, of Garden Street, Heywood, Lancashire, a three-page folder describing the application of Doric Flux. Though it is not too clearly stated, we understand that there are two types of this flux, the one being suitable for non-ferrous and the other for ferrous founding.

SWAN, HUNTER & WIGHAM-RICHARDSON, LIMITED, Wallsend, have secured an order for a steamer of 7,000 tons deadweight carrying capacity, for Messrs. Harrison, of Liverpool. The engines will be constructed by the Wallsend Slipway and Engineering Company, Limited, Wallsend.

# Discussion of Foundry Exhibition Technical Congress Papers.

By E. H. Brown.

## Economy in Foundry Practice.

PROFESSOR T. TURNER, as chairman, opened the meeting by saying that there were many ways in which the subject of economy in the foundry might be regarded, either from the point of view of statistics or finance. Mr. Brown was dealing with the subject in a practical manner, and therefore it should commend itself to them, because they so often heard Papers full of scientific formulæ or with complicated diagrams that it was difficult for many foundrymen to understand or grasp their meaning in a brief sitting.

MR. E. H. BROWN prefaced his lecture by remarking that it was impossible for him to cover the whole of the subject in a single evening; it was far too vast to be dealt with even in one volume. But he had attempted to give some of the main headings under which perhaps the great majority of foundry work came. He had avoided entering into the scientific aspect, and kept strictly to the practical side, including perhaps a smattering of the commercial element. After all, it was the man who bought and sold well who made money, though when they came to manufacture the product, it must be turned out in the cheapest way in order to sell at the cheapest price and compete with similar goods manufactured elsewhere.

The CHAIRMAN remarked that they would all agree Mr. Brown had brought to their notice a wide range of points in connection with the practical conduct of work in the industry. But as he had suggested previously, on subjects of this kind there were often considerable differences of opinion, for what one man found right in his foundry another man might find wrong under somewhat different conditions.

Answering Mr. D. S. Dubash (Bombay), who said he could not follow the argument which he understood Mr. Brown made regarding the loss of time both by the pattern maker and moulder when the former was showing the moulder how to read and carry out a drawing, the CHAIRMAN said the point was that if the moulder was supplied with a drawing and able to read it so as to work according to it, then it did not require the presence of the pattern maker; hence one man could do the job instead of two, otherwise one of them would be watching and be idle.

### The Reading of Drawings by Moulders Saves Money.

In reply to Mr. C. R. Horrell, who inquired how the lecturer would make the moulder's life a little more interesting, seeing that it was rather difficult to deviate his work other than in the way suggested, MR. BROWNE recalled that some two and a-half years ago he had the pleasure of working in an Amsterdam foundry for a few weeks. It was a large foundry, in which the men were engaged in the production of Diesel engine castings, locomotive steam cylinders, turbines, etc.—nearly all big work. He must admit that the Dutch workers certainly seemed to take a deeper interest in their calling than the men employed in foundries in this country. As regards the moulder being taught to work to the drawing, if he was doing a job in loam, instead of having the pattern maker in to set up the shape, he would with a little experience be able to set it up himself. He knew the appearance of the finished castings, and by taking responsibility for the job, the moulder would have far more interest in it than if he were merely looking on and seeing someone else do the preliminary work. With that particular method, of course, the cost question came into consideration. If they had a pattern maker working in a foundry, they were paying him for time which on occasions might be better employed in the shop, and they were also paying the moulder for looking on. In similar classes of work they could often obtain more interest from the moulder, if only they provided some inducement for them to do something beyond the dead routine. Many of the most valuable time-saving and economical suggestions came from men who at one time or another had been at work inside the foundry or in other departments, and if they could secure these suggestions from the men while they were actually engaged on the sand floor, a considerable saving could be effected long before these men became masters themselves or gained promotion. As for creating a greater interest all the way round in the foundry, here they were up against serious difficulties, in some shops in a greater measure than in others. The best advice he could give was that they should look round other foundries and take note of the conditions which particularly applied to their own works—things which could not be spoken about in a general way as they affected economy, because no two shops worked under exactly similar conditions.

### Economy and Workmen's Self-Respect.

THE CHAIRMAN said there was one thing he had often thought about in connection with interesting men in their work. This was the maintenance of their self respect. Sometimes he had been smiled at for making suggestions of the kind. That afternoon he was passed by some hundreds of men who had just come out of some large works; there was not a clean man amongst them. No doubt, as he himself was wearing a clean collar and a black coat, they thought of him as a gentleman, but there was no reason why these men should not have turned out just as tidy, should he say, as he was. It was a very striking thing to note on the Continent—in Holland, Germany and France, and also to a considerable extent in many parts of America—that the workmen engaged on the floor, when they had finished for the day, allowed themselves a few moments in which to wash their hands and faces and brush their hair, and to put on an outside coat. These men then walked along holding up their heads, considering themselves to be worthy working men and entitled to other people's respect. That was the kind of spirit they ought to encourage in this country; they did not want the workers to grouse and imagine that other people were doing something wrong to them, simply because they happened to be looking a little bit better groomed. They desired workpeople to regard themselves in the light of good citizens and workers, just as much as the cleaner and neater dressed folk were, and he did not see any reason why they should not do so. If they induced men to respect themselves they would invariably do good work and respect their work; they would know where their tools were to be found, and would not be so often losing and breaking them. The result would be that a spirit of comradeship and cheerfulness would be displayed in their workaday life, for they would take an interest and pride in their work and in themselves, and he believed it would be well worth the time and money spent by employers in endeavouring to promote this feeling of a proper recognition of their own importance on the part of their craftsmen.

### Should Patternmakers Set Bosses?

MR. E. LONGDON said it might be economical in very small foundries for the moulder to work to the drawing, but in large foundries it would be a great waste of time for the moulder to set his own bosses, etc. It was a more commercial proposition for the patternmaker to come in and set them, and moreover he could be relied upon to do so more accurately.

THE LECTURER observed that the Continental system was totally opposed to that on economical grounds, and the costs were considerably more here than there.

### Utilising Slack Period Time.

MR. D. S. DUBASH remarked that most of the foremen in foundries and in machine shops required the workmen to be doing something, in spite of the fact that sometimes there was no work to do. This was sometimes done quite uselessly in order to demonstrate to the owner that the men were not idle. Workmen could not possibly take

an interest in their work when in their spare moments they were not allowed to read, but were told in effect to pretend to be working. It was a habit which induced wasting time. Men who understood that in their slack time they could break off to read would tend to have their self respect encouraged.

MR. BROWN replied that the obvious thing was that they should never have a man in the foundry with no work at hand. Work should always be found ready for them and resorted to as a stand-by, rather than that they should be wasting time or pretending to work, for no one wished to encourage lazy habits or slyness. A foreman who resorted to such measures would find that in practice they recoiled on his own head. Plenty of work could be found, apart from production orders, in the way of making new boxes and tackle. There was often too much equipment in a foundry which was in a bad state or dilapidated, and this could be said even of the newer foundries. If they desired to keep good moulders and there was not sufficient work to do, there was always an efficient way of utilising their time for equipment purposes.

**Interesting Foundry Personnel.**

MR. LONGDEN, speaking of stimulating interest in the moulding department, said he could not quite see eye to eye with one of the previous speakers, who asked how could they make iron foundries more interesting. Personally, he thought moulders found their trade thoroughly interesting—so much so as to be almost baffling at times. So far as this remark applied to the turner or miller, there was no comparison between them. He happened to have had the supervision of foundries where smoking was allowed, and also of some where it was prohibited, and he himself was strongly against this privilege in the shops, because it set a bad example to youths employed there and made the men collect in undesirable places at intervals of the day.

MR. HORRELL replied that he should not have taken up moulding work had he not found it most interesting. But he was really inquiring as to how interest could be stimulated for the repetition moulder, not the job moulder. It was up to the management of foundries to make the men more interested in their jobs, and not to regard them simply as cogs in a machine. In a humble way his firm had provided something—a small canteen where the men could enjoy a song and a smoke during the winter evenings. He suggested that employers and foremen should realise that it was necessary to get into close touch with their men and give them a lead, and this had a particular bearing on the number of entrants into the trade in the future. The employer who knew his men and could lead them was to-day going to obtain much better results than the employer who never spared any time from his weekly golf.

THE CHAIRMAN concluded the discussion by acknowledging the many interesting points in the Paper and in the discussion, and expressed to the author the appreciation of the audience for the trouble he had taken.

**Sillimanite for Super Refractories.**

An investigation having for its purpose the production, by electric-furnace methods, of materials of higher refractoriness than those commonly used in commercial practice is being conducted by Seattle, Wash., experiment station of the American Bureau of Mines. Such refractories have been called super-refractories. The first material to be investigated is sillimanite. Two methods of preparing the material are being studied: From a mixture of clay and aluminium oxide in the form of bauxite, diaspore, or alunite residue; or from clay alone by removing the requisite amount of silica and the iron by melting with carbon in the electric furnace. The material thus produced in the electric furnace is then subjected to the methods of testing refractory materials, and is fashioned into brick and other shapes, and given both refractory and commercial tests. Encouraging progress has been made in this investigation. It is expected that the work on sillimanite will be completed during the present fiscal year, and that another material will be taken up.—"Iron Age."

# The Nick-Bend Test for Wrought Iron.*

BY HENRY S. RAWDON AND SAMUEL EPSTEIN.

The "nick-bend" test is a requirement included in most current specifications for wrought iron, the character of the fracture being the criterion by which the material is judged. This test has, without doubt, been developed from the blacksmith's method of breaking a metal bar by notching and then completing the break by a few sharp hammer blows. In American specifications for wrought iron, the "nick-bend" clause allows very considerable latitude in carrying out the test; the nicked specimen may be broken "either by pressure or by blows."

This investigation was carried out to show how the results may vary with the method used, and was based upon a series of twelve grades of iron manufactured to meet certain A.S.T.M. specifications. All specimens were notched in the same manner, the testing machine and a special chisel being used. The specimens were fractured in different ways, varying from simple transverse bending to a single-blow, impact test.

The results indicated that the rate at which the fracture is produced is of fundamental importance in determining its character. Crystalline areas were found in the fractures of all the bars broken by severe impact. The same materials, however, when broken by a slowly applied stress, as is permitted by most specifications, gave a fibrous break. The character of the iron also affects the results. Wrought iron containing small slag threads which are uniformly distributed show larger crystalline areas in the fractures after the nick-bend test than do irons that are not so uniform. Open-hearth iron, which contains no slag threads whatever, practically always gives a crystalline break, no matter how the break is made; while wrought iron with prominent slag streaks is apt to split and sliver, thus giving a fibrous appearance.

The test is popularly supposed to indicate whether the iron contains "steel." The results obtained show definitely that crystallinity is not necessarily indicative of steel; although, on the other hand, steel streaks, if present, do appear to aid in producing a crystalline break; nor can the test be used for indicating whether the iron is high in phosphorus or not.

Only the very coarsely granular, sparkling areas in a fracture should be considered. Many fractures contain portions which, by the inexperienced man, may be mistaken for "crystallinity." There were two distinct types of crystalline areas—one on the tension side of the bar, the other in that part subjected to compression. That on the compression side of the specimen is caused by the flattening of the grains of the material by compression during the progress of the test. Such areas should not be considered as indicating the same property of the material that the "tension" areas do.

A series of notched-bar impact tests of open-hearth iron (ferrite) was carried out for the purpose of showing how "crystallinity" is related to grain structure. The results indicated that an increase in grain-size, such as occurs upon annealing, is not necessarily accompanied by low impact resistance. Uniformity in shape and size of the enlarged ferrite grains is usually indicative of a transcrystalline fracture ("crystallinity"), and a low resistance to impact. Similar material treated in the same manner, but showing a somewhat irregular "interlocking" grain structure, gave a relatively high impact resistance and broke with a fibrous fracture.

In general, the results obtained indicate strongly the need for defining more strictly the conditions for carrying out this test than is the case in most American specifications. In particular, the manner of application of stress should be definitely stated. The nick-bend test, as often carried out, is an approximation of the notched-bar impact test.

F. H. HAYWARD & COMPANY, LIMITED, Motor Department, sole concessionnaires for the "Delahaye" car, etc., have opened their head office at 96-98, Leadenhall Street, London, E.C.3, and the showrooms at 40, Pall Mall, London, S.W.1, will be ready on August 18.

* Abstract of U.S. Technologic Papers, No. 252.

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## Trade Talk.

MR. F. S. SPIERS, secretary and editor to the Faraday Society, has removed from 10, Essex Street, Strand, W.C.2, to 90, Great Russell Street, London, W.C.1.

MR. D. S. EASTWOOD, secretary of Whyman's Foundry Company, Limited, Warrington, has been the recipient of presentations from the officials and men on the occasion of his retirement.

STANFORD & COMPANY, engineers, ironfounders and boilermakers, of Colchester, are closing down their works owing to trade depression. The firm has been established for over a century.

AT AN ADJOURNED conference between representatives of the employers and of the unions connected with the engineering industry, the application of the men for an advance of wages of 20s. a week was considered. The application was refused, and the employers made no alternative proposal. The unions will hold a meeting immediately to decide upon their next step.

MR. JOHN ANDERSON, chief engineer of the Lakeside (U.S.A.) Power Station, who is at present visiting this country, and Mr. Frank Hodges, Civil Lord of the Admiralty, were the guests of honour at a banquet given at the Connaught Rooms, London, last week by the Underfeed Stoker Company, Limited. Mr. W. Selvey presided. Mr. Anderson delivered a lantern lecture descriptive of the inauguration and development of the pulverised fuel system of power production at the station of which he is in charge. He traced the history of the new system of power-production and demonstrated the economic advantages of the use of pulverised fuel over the old methods of stoking.

THE SECOND ANNUAL CORPORATE MEETINGS of the Institution of Chemical Engineers were held at the Hotel Cecil, London, recently, Sir Arthur Duckham presiding. The new seal of the institution, showing the emblematic watering of the "Tree of Knowledge" by the "Fountain of Chemistry and Engineering," was presented to the institution by Sir Arthur Duckham as a memento of his presidency. In his presidential address Sir Arthur Duckham urged the elimination of redundant effort in the matter of general societies, and pleaded for specialisation with affiliation. Similar societies should be housed together in one central building. The specialist could not gain very good results by joining societies which involved a number of specific branches of a profession. The technical administrator of the future would have to be a chemical engineer. In the future they would have to obtain closer relationship between industrial concerns, institutions, public schools, Universities, and technical colleges. Papers were read by Mr. E. A. Alliott, Mr. G. W. Himus, and Mr. J. W. Hinckley.

## Contracts Open.

**Wokingham,** August 9.—Ten-ton steam roller, etc., for the R.D.C. Mr. A. H. Prince, surveyor, Council Offices, Wokingham.

**Mendoza,** September 11.—Pumps, etc., for the Argentine National Sanitation Works. The Department of Overseas Trade.

**Cape Town,** August 25.—Brass piping, etc., for the South African Railways and Harbours. The Department of Overseas Trade.

**Blackpool,** August 5.—Valves, etc., for the Fylde Water Board. Mr. J. Cook, engineer, Head Office, Sefton Street, Blackpool.

**Monte Video,** September 15.—Iron supports for aerial wires, for the State Electric Works of Monte Video. The Department of Overseas Trade.

**Constantinople,** September 23.—Fifty safes, for the Direction de l'Intendance des Postes et Telegraphes, Constantinople. The Department of Overseas Trade.

**Dublin,** August 9.—Metals, for the Dublin Electricity Department, for a period of one year. The City Electrical Engineer, Fleet Street, Dublin. (Fee, £1 1s., returnable.)

**Dunmow,** August 15.—Cast-iron pipes, etc., for the Dunmow Rural District Council. Sands & Walker, Milton Chambers, Milton Street, Nottingham. (Fee, £2 2s., returnable.)

**Little Downham,** August 9.—Pumping station, for the Commissioners for the Littleport and Downham drainage district. Mr. E. J. Silcock, 25, Victoria Street, Westminster, London, and 10, Park Row, Leeds. (Fee, £5, returnable.)

**Sydney.**—Manufacture, supply and delivery of metal-work for one steel lift span, four steel truss spans and steel superstructure for nine approach spans for a bridge over the Murray river, for the New South Wales Department of Public Works. The Department of Overseas Trade.

# IRON AND STEEL MARKETS.

## Pig-iron.

**MIDDLESBROUGH.**—The depressed conditons of the Cleveland iron trade previously reported continue without signs of abatement, and as far as the present outlook is concerned, without any immediate hope of improvement. This qualification applies with equal force to both the home and export position of the industry, consumption of pig-iron in this country having reached an even lower average than is usually experienced, even in the holiday period of the year, while shipments this month so far are much reduced from the poor total of June tonnage. On the Tees-side market last week the tone was quite despondent, and it was by no means helped by the announcement that an important and old-established firm of coal and pig-iron exporters have suspended payment. Traders, nevertheless, are hopeful that once August is out, there may be a revival of business in the home trade.

The depression in foundry iron is being experienced with at least equal severity in the hematite trade. Stocks are accumulating, and it is to be feared that there will be even further curtailment of production unless trade quickly improves. East Coast mixed numbers can now be done at 94s. 6d. per ton, with 6d. per ton more for No. 1, but bargains would probably be negotiable for suitable business. Similar conditions to those outlined above also prevail on the North-West Coast, nominally, Bessemer mixed numbers standing at 106s. per ton delivered at Glasgow, 110s. per ton delivered at Sheffield, and 115s. per ton delivered at Birmingham.

**LANCASHIRE.**—No signs of improvement are apparent in market conditions in this district, ironfounders being very reserved and not inquiring for metal; but whether this is because they have no orders for castings, or whether it is because they expect to get the iron on cheaper terms, is difficult to explain—perhaps a little of both. The price of No. 3 Derbyshire iron is now openly based on 89s. 6d. at the furnaces, and this means about 97s. in the Manchester district.

**THE MIDLANDS.**—Only a very limited volume of business is reported in foundry pig at the moment, the great majority of local ironfounders just buying from hand to mouth, in anticipation that by the middle of August prices will be on a lower level than at present. Certainly, the existing figures are not strong, and it is difficult to estimate what price could be obtained if a good tonnage was offered. Current quotations rule as follow:—Derbyshire No. 3 foundry, 89s. to 90s.; Staffordshire No. 3 foundry, 90s.; Northants No. 3 foundry, 82s. 6d. to 83s. 6d.

**SCOTLAND.**—As is customary during the celebration of the annual "Fair" holiday in the Clydeside area, work is practically suspended, and markets are at a temporary standstill. In the absence of business prices for Scotch foundry iron are unchanged, No. 3 quality remaining at 93s. 6d. per ton f.o.t. furnace.

## Finished Iron.

It is no exaggeration to describe conditions in this branch of the industry as deplorably bad. They may have been worse in the past, but there is no one who has been actively connected with the industry long enough to remember it. Apart from those works which have been closed for weeks, it is nothing uncommon to hear of others which have been standing for a whole week for want of work. The whole position seems perfectly hopeless. Prices are too high to command business, but they are so unprofitable that they cannot be reduced.

## Scrap.

Demand for all classes of scrap material is still on a minimum scale, and reflects in a general sense the stagnant conditons in the iron and steel markets in most centres of the industry. The position in the Lancashire foundry scrap market continues uncertain. There are local dealers who still quote 90s. per ton for good lots of broken machinery iron, but there are also weak sellers in the market, and it is said that good cast scrap can be bought at about 85s. per ton. The further fall in the price of foundry pig-iron is telling on the scrap market, as might be supposed, and as No. 3 pig-iron is now 5s. cheaper than it was when the price of scrap was at 90s., it is not surprising that weak sellers are ready to accept 85s. Of course, cast scrap is cheap, but ironfounders are in need of cheap foundry material if they are to compete with districts where the pig-iron is some 10s. cheaper than it is in Manchester.